ELECTRONICS

Australia

with HIFI NEWS

JANUARY, 1979

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ACT20

ELECTRONICS Australia

VOL. 40 No. 10 JANUARY, 1979

Australia's largest selling electronics & hi-fi magazine

Car stereo system lacking in power? This new booster amplifier is easy to build and will deliver 12 watts per channel. Full details on p38.

Our final article on the Playmaster AM-FM Tuner this month gives tips on reception, and includes a useful troubleshooting procedure. See p49.

On the cover

Our cover this month (and above) illustrates the growing uses of solar cells — from charging batteries on a yacht to powering an electric toothbrush! This month, our Reader Service Department is offering the solar panel shown in these pictures at an attractive price. See p19 & p61 for the details. (Pictures courtesy Ian Carter Photography, Sydney.)

FEATURES

HIFI NEWS AND REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

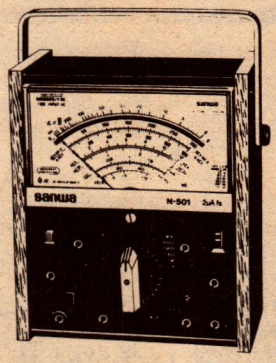
DEPARTMENTS

REAL POWER LINE UP

sanwa

AX-303TR

44μA meter movement — Si diode protection against pulse input.
Measures hFE (0-1000) by using the extra connector.

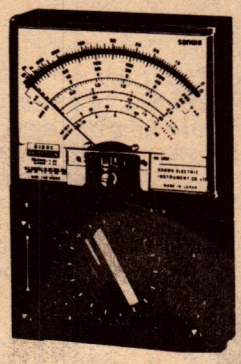


N-501

2μA suspension movement — 0.05mA/1mV resolution.
Double protection — fuse & Si diode.
Constant 1MΩ input impedance (ACV) — RF-diode rectified current direct to movement.

BX-505

Fast-response, 24μA movement — fuse & diode protected with high resolution factor. (0.4μA/scale division)
Revised scale marking — intermediate readings readily determined.

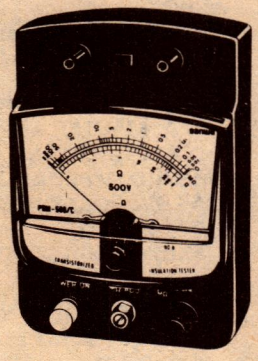


U-60D

44μA movement — quality performance, diode protected.
Temperature measurement of −30°C to +150°C with extra scale.

CAM-250D

Clamp meter
Economical and multi-function. Single motion core arm.
Compact yet provides 4 ranges on ACA and 2 ranges on ACV.



PDM-500/C

Performs as low resistance ohmmeter besides insulation tester.
Measurement, scale calibration and battery check are all operated by pushbutton switches.
Has constant voltage impressed irrespective of the value of resistance checked.

N-501

● ±DCV 0-60m 0-0.3-1.2-3-12-30 0-120-300-1.2k-30k (w/HV probe) ● ±DCA 0-2μ 0-0.3-0.3-1.2-3-12-30m 0-0.12-0.3-1.2-12A ● ACV 0-3-12-30-120-300-1.2k ±2.5% Freq. 20Hz to 50kHz ● ACA 0-1.2-12 ● Ω x 1-x10-x 100-x 1k-x 10k-x 100k (max. 200M) Batt. 1.5V x 1 & 9V x 1 ● dB −20 to +63

AX-303TR

● ±DCV 0-0.3-3-12-30-120-300-1200 ● ACV 0-6-30-120-300-1200 ● ±DCV 0.60μ -3m-30m-0.3-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

U-60D

● DCV 0-0.1-0.5-2.5-10-50-250 -1k-25k (w/HV probe) ● DCA 0-50μ -2.5-50-500m ● ACV 0-2.5-10-50-250-1k ● Ω x 1-x 10-x 100-x 1k (max. 5M)

BX-505

● ±DCV 0-0.12-3-12-30-120-300-1200-30k (w/HV probe) ● ±DCA 0-30μ -3m-30m-0.3-12 ● ACV 0-6-30-120-300-1200 ● ACA 0-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

CAM-250D

● ACA 6-30-60-300 ● ACV 300-600 ● kΩ 0-50k ● Batt. 1.5V x 1

PDM-500/C

● V/Ω rated 500V/100M ● Scale range 0-0.1-100-200m (1st effective scale range underlined) ● Ω 0-100Ω ● Power source AM or UM-2 x 3

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Editorial Viewpoint

We'll get what we accept!

Recent inquiries into the tenure of radio and television licences, conducted by the Australian Broadcasting Tribunal, have raised a great many social issues, without obviously resolving any of them. The views expressed by witnesses have been diverse and conflicting — so much so that the extremes have tended to cancel, adding to the appeal and the seeming inevitability the median view.

If one chose to be cynical, one might conclude that, after the huff and the puff have died down, nothing will really have changed. That, while paying lip service to their social obligations, station managements will simply revert to the old programming patterns for as many years as it takes to stir the pot again!

It need not be so, however.

For perhaps the first time, station executives have been put on the spot — under the full glare of publicity — and subjected to some highly uncomfortable periods of question and challenge. Right now, they are very conscious of the force and breadth of the new industry in-word: "accountability".

They are fully aware that, in the future, accountability may not be simply to a board and to shareholders. Rather, along with the board, they may be answerable to the Tribunal, the Government and, through them, to listeners and viewers.

At risk: the very licence by which the station operates.

But why did I say "may" be answerable? For the simple reason that the spirit of examination and challenge, which has recently emerged, could as easily subside.

Once the current series of inquiries are over, the Government could back off, the Broadcasting Tribunal could become an administrative formality and the public could go back to sleep. That would indeed be the signal for station executives to pass up the whole 78/79 thing as a bad dream, and to fall back into their old value judgements.

While we may look to the Tribunal and to the Government to maintain the pressure on programming standards and practices, the plain fact is that, in the ultimate, the pressure must come from the public at large: from the listeners and viewers themselves. If we sense that what is being served up on radio and television is repressive or mindless or inappropriate or anti-social or obscene — or anything — then we should continue to protest publicly and, in particular, to our Federal member.

That way, we will keep alive the spirit of question and challenge and emphasise to the Government and to the Tribunal that there is an on-going job to be done. If I can repeat the words of the heading: In terms of radio and TV programs "we'll get what we accept!"

Some might even say: "We'll get what we deserve!"

— Neville Williams

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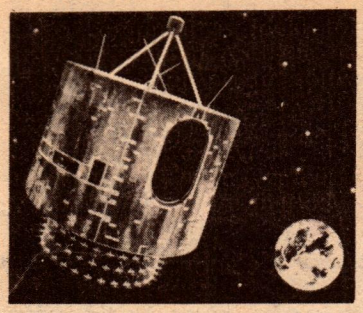


News Highlights

NS sets sights on European auto manufacturers

National Semiconductor Corporation, well on its way to becoming a major supplier of semiconductor devices for use in advanced electronic systems in US autos, is now planning a major effort in Europe.

"European automobile manufacturers are a major factor in the worldwide auto market with 41% of the worldwide automobile production facilities," says Thomas Anthony, industry director for automotive electronics at National Semiconductor. NS is committed to becoming the major supplier of auto electronics worldwide, he says, and Europe is a key to that effort.

NS has identified five key areas in the automobile, says Anthony, which can be enhanced through the use of advanced semiconductor technology:

- **Engine** — the area of most growth to meet fuel economy and emission demands;
- **Entertainment** — the next generation of equipment will be in the area of electronic tuning and AM stereo;
- **Instrument Panel** — electronic clocks, speedometers, tachometers, displays and trip computers;
- **Body** — illuminated entry, temperature, lighting and antiskid controls;
- **Sensors and Transducers** — This is the key to the all-electronic auto and an area in which National Semiconductor has been a pioneer.

According to Anthony, the semiconductor impact in the automotive industry will be close to half a billion dollars by model year 1981. "That is about $39.50 of semiconductors in every car," he says, "with about $30 of this just to meet US legislated engine controls." It is National Semiconductor's plan over the next several years to experience strong, yet controlled growth in the auto industry.

Webster Spectrum II minicomputer goes double density

Computex Data Product's, a division of D.D. Webster Electronics Pty Ltd, has released double-density floppy-disc versions of its LSI11-based Spectrum-11 minicomputer.

The new minicomputer can provide over 2.5 megabytes on-line, four times the disc capacity of the previous model released by the company just over a year ago. It is available in single or double sided versions from $7000, hardware only, and has been designed for sale to original equipment manufacturers or experienced end users who can create their own application packages.

The computer is ideal for small businesses and in Australia has been sold with appropriate software to doctors, lawyers, accountants, wholesalers and retailers. Its designer, Mr David Webster, visied the United States and Canada in October, seeking a North American market for his computer.

Spectrum II can provide up to 2.5 megabytes on-line, and is ideal for small business applications and in hospitals. Overseas markets are sought by its Australian manufacturer, D. D. Webster Electronics Pty Ltd.

Big defence contract to Racal

Racal Electronics Pty Ltd has won the largest defence communications contract ever awarded by the Australian Government, and will supply transportable HF radio communications stations to the Army and the RAAF. The contract is worth over $15 million.

Australian designed FM transceiver

A new mobile two-way radio, the "Movar FM," has been launched onto the local market.

The radio, designed entirely by Australian engineers, is now coming off the assembly line at the Motorola Australia plant at Mulgrave in Victoria. Motorola claim it has already attracted wide interest overseas, with inquiries coming from Germany, Britain and South East Asian countries.

With Movar, only the control head, microphone and speaker need be inside the driving compartment of the vehicle. The main component of the radio can be mounted in the boot or engine compartment of a car or truck; or under the chassis, for example, of a tractor or low loader.

Motorola says that Movar has been specially designed for Australian conditions, and is highly resistant to heat, dust and humidity.

Magazine on computer fraud

Computer crime is on the increase in advanced countries, so much so that Elsevier International Bulletins of the UK has commenced publication of a new monthly bulletin called "Computer Fraud and Security".

According to the publisher, "Computer Fraud and Security" will strive to alert management to the risks of computer abuse. Most cases of fraud have so far been discovered only by accident. The bulletin aims to supplement this accidental discovery factor by helping subscribers implement systems and policies based on informed understanding of the problems.

The editorial scope of the new bulletin will cover: reviews of computer crime; products and programs; auditing; people problems; legislation; pre-employment screening; investigation of fraud; industrial espionage; terrorism; and fraud detection techniques.

For information on subscription rates write to Elsevier International Bulletins, Mayfield House, 256 Banbury Rd, Oxford OX2 7DH, England.

64K RAM chip

US semiconductor giant Texas Instruments will start production this year of the world's first commercial 64K dynamic RAM — a silicon "random access" memory with 65,536 logic elements crammed on a single chip. First production samples of the 64K device have already been produced. TI expects the 64K RAM market to be viable only to 1984, after which increasing levels of integration should mean memories in standard use are 256K at least.

Fibre optic communication link

A new, complete fibre optic link for data communications applications that requires no expertise in optical design, calibration or adjustment has been introduced by Hewlett-Packard.

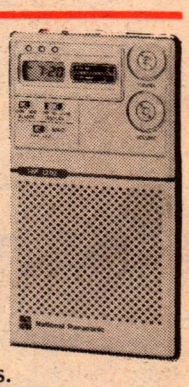
The new HFBR-0010 low error rate fibre optic link system makes the use of fibre optics simple and practical for a broad range of customers. It comes ready to hook up, and consists of a digital transmitter, a digital receiver, a single fibre, 10 metre connector/cable assembly and complete technical literature.

Using fibre optic techniques, digital information is carried via light waves instead of electronic signals using traditional methods. Benefits include immunity to electro-magnetic interference; lack of radiated signal; absence of electrical path between terminals; lightweight and flexibility; and broad bandwidth over long distances.

Typical applications of the new link include: large computer installations; distributed processing systems; hospital computer systems; power plant communications and control; and process control etc.

For further information contact Hewlett-Packard's official component distributor: Amtron Tyree Holding Pty Ltd, 176 Botany St, Waterloo 2017.

IT'S THE 100 MILLIONTH FOR MATSUSHITA ELECTRIC



Ultra-thin AM-FM radio from National Panasonic. Features of the unit include a quartz-crystal clock, alarm, and liquid crystal readout.

The Matsushita Electric Company of Japan, makers of National Panasonic and Technics sound equipment, has become the first organisation in Japan to achieve a production record of 100 million radios, according to Mr J. Ukita, Managing Director of National Panasonic (Aust.) Pty Ltd.

Mr Ukita said that the 100 millionth set, one of the National range of ultra-thin types, came off the line last August. He said that while it took 40 years from 1931 to achieve the 50 million mark, production of the next 50 million radios had taken only 7 years.

Out of the 100 million sets produced, 31 million were sold in Japan and the remainder in more than 130 countries throughout the world.

NEWS HIGHLIGHTS

New IC obsoletes TV hold controls

National Semiconductor Corporation engineers have developed an integrated circuit that could make both horizontal and vertical hold controls (including factory presets) in television sets obsolete. What's more, no adjustments would be required for the life of the receiver.

Designated the LM1880, the IC chip is designed to operate with a new ceramic resonator made by MuRata Corporation of America, Rockmart, Georgia. This gives a more accurate initial frequency reference than the LC and RC voltage controlled scanning oscillators now used in most television receivers on the market. According to product marketing manager Charles Smaltz, the LM1880 will deliver a phase locked loop horizontal scanning frequency and, counting down from that, obtain an injection locked vertical output pulse.

Heart of the LM1880 is a precision 32 times horizontal frequency VCO, designed to use the MuRata resonator, and accurate to within plus or minus 2kHz of a 503.5kHz centre frequency.

The VCO signal is then divided down in the horizontal section to produce a pre-driver output, which is locked to negative sync by means of an on-chip phase detector. The vertical output ramp is injection locked by a vertical sync signal subject to a sync window derived from a 542 element countdown section. Should no sync pulse arrive in the time period following the 510 count, the counter will continue to 542 when an automatic reset will occur, generating a vertical output pulse. If the horizontal output is locked to 15,734kHz (US NTSC standards) then the vertical output can be "injection locked" from 58.1 to 61.7Hz.

The linear portions of the chip — about 60 percent — include the VCO and phase detector and are implemented using a standard linear process. The rest of the chip — the countdown circuitry — is implemented with integrated injection logic (I^2L).

The LM1880 also generates a burst gate pulse centred on the chroma burst. It will be available on the US market for $1.50 each in 100-up quantities.

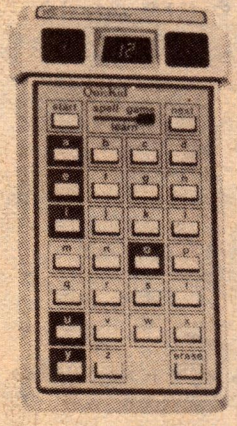
English as she is spelt!

National Semiconductor has announced a new product that applies electronic technology to the problem of teaching children to spell.

Looking somewhat like an electronic calculator, the "Quiz Kid Speller" has three modes of operation: the "Learn" mode, which can be mastered by children as young as three; and the "Spell" and "Game" modes which can hold the attention of children up to 12 years and older.

Included with the unit is a completely illustrated game book which pictures 99 different words that have been selected from six different levels of word difficulty.

In the Learn or Spell mode, the display shows a series of ten randomly selected game book page numbers. The child spells the name of the picture on that page by pressing the alphabet keys. The green light glows on correct spelling, and the red light glows for incorrect spelling. The score, five points for correct answers on the first try, three points on the second try, and one point on the third try, is accumulated and displayed at the end of each series.



The Quiz Kid Speller — taking the boredom out of learning to spell. Other Quiz Kid products teach the basics of mathematics.

In the Learn mode, the child scores by correctly entering the first letter of the word. In the Spell mode, the child scores by correctly spelling the entire word.

The Game mode can be used to play many different word guessing games, or any word up to nine letters long can be keyed in. The display then shows the number of letters in the word, and the number of times a guessed letter appears in that word. The score is displayed on completion of the word.

The Quiz Kid Speller will be available in Australia in February, and will cost around the $30 mark without batteries.

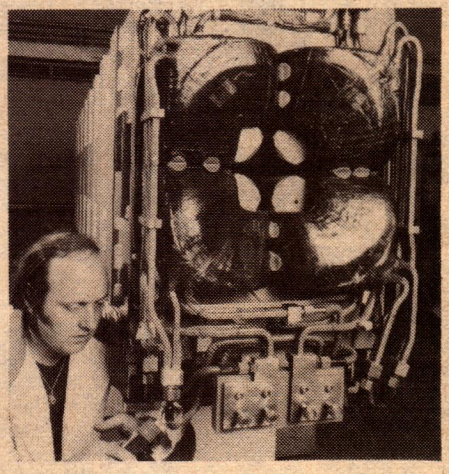
High power MOSFET

Originally developed for low power signal handling, the field effect transistor (FET) has now moved into the high power switching market with the announcement by International Rectifier (UK) of a device capable of handling over one kilowatt in switching power supply applications.

International Rectifier says that, in the next few years, the power MOSFET will secure a major share of the power transistor market. The company claims that the power levels achieved in its new device are more than double those of any comparable units previously available.

The new devices should make possible a significant reduction in equipment size and give high reliability and efficiency in applications such as power supplies, motor controllers and lighting controllers.

Super magnet



Twenty tonnes of magnet is checked at a British factory before despatch to the Centre for European Nuclear Research (CERN) in Geneva, Switzerland.

The magnet is of the quadrupole type and will form part of the new North experimental area at CERN. The North area is linked to the giant Super Proton Synchrotron (SPS) particle accelerator.

The quadrupole magnets will be used to accelerate sub-atomic particles called protons away from the main accelerator ring and into the new experimental area where further research can be conducted. Other magnets control the centralisation of the beam of particles as it hurtles along within a vacuum tube reaching a terminal velocity of 99,9997 per cent of the speed of light!

Dick Smith says:
Just look at this INCREDIBLE HOME ENTERTAINMENT COMPUTER!

BE ONE OF THE FIRST TO ENJOY THIS AMAZING COLOUR COMPUTER – CONNECTS TO ANY TV SET.

Manufactured by FAIRCHILD The US Electronics Giant.

Cat X-1200

*EDUCATIONAL!

Your children can actually learn or improve mathematics: addition, subtraction, multiplication and division right there on the TV screen. It even tells you when you're wrong or right!

*EXCITING!

You can play incredibly complex games like **BLACKJACK!** Imagine: it actually draws your cards, raises the bet, 'pays' you for a win . . . **you won't believe it!**

*NEW!

Over twenty thousand sold in the USA since its release a short time ago – now available in limited quantity here in Australia. Don't miss out!

Imagine! For only $259 you get a real computer – the heart of this unit is an incredibly powerful Fairchild microcomputer containing thousands of transistors. No, this is not just another TV game – this incredible machine has a mind of its own, giving versatility and performance not even thought possible just a few months ago!

Basic price includes the computer console with two inbuilt games (tennis and football), the two 8-way hand control units, an AC power supply plus a BONUS 'noughts & crosses' game cartridge.

$259.00

Easy terms available!

Call in today for a demonstration

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A pleasure. To approved personal shoppers, terms are available from $29.00 deposit and $2.90 p.w.

MAIL ORDERS:
Yes. We'll send this unit anywhere in Australia for $5.00 extra – game cartridges post FREE with unit. (If purchased separately p&p $2.00)

ADD MORE EXCITEMENT! ALL OF THESE FULL COLOUR CARTRIDGES ARE NOW AVAILABLE!

ONLY $24.50 EACH.

BLACKJACK Cat X-1201
You can play the TV (the bank) by yourself or with a partner. Try to break the bank at your home without losing a cent!

DESERT FOX Cat X-1203
Try and destroy the desert fox without being blown up yourself (tank game) – or try the shooting gallery game on this cartridge.

MAZE Cat X-1204
Four great games: Maze, Jailbreak, Blind-man's-bluff and Trail-blazer. Games that will test your skill and give you feal fun.

BASEBALL Cat X-1205
All the skills and thrills of the real game – played in the comfort of your own home. For two players.

SPITFIRE Cat X-1206
Two games: Solo the red baron is hot on your tail, or for two players you try to shoot each other out of the sky.

SPACE WAR Cat X-1207
Can you escape the piercing laser beams? The aliens from outer spaec are out to get you. Just how good are you?

MATH QUIZ 1 Cat X-1208
Teach the kids addition and subtraction – or brush up on your own basic arithmetic skills.

MATH QUIZ 2 Cat X-1209
Multiplication and division on this cartridge. It poses the problems – it's up to you to come up with the answers

PINBALL CHALLENGE Cat X-1217
Remove different coloured walls of bricks to become the pinball wizard.

BACKGAMMON Cat X-1213
All the rules of this exciting game are programmed on the cartridge. No cheating! Also has Acey Ducey (a variation of Backgammon)

TORPEDO ALLEY Cat X-1211
Sink as many ships as possible. Or play Robot War – try and escape the robots by destroying them in a force field.

SONAR SEARCH Cat X-1214
Use your ears to try to sink the enemy's hidden fleet. Hours of fun for everyone.

DODGE IT Cat X-1216
Dodge a varying number of hidden balls to win this game. Tests your endurance!

MEMORY GAME Cat X-1215
Number come and go. But can you remember where they were? A modern version of Kim's game.

MAGIC NUMBERS Cat X-1210
Guess the right digits in the right places to win. You can play the clock or play for points.

DRAG RACE Cat X-1212
Don't eat dust: stomp on your accelerator and beat your opponent in an exciting drag race.

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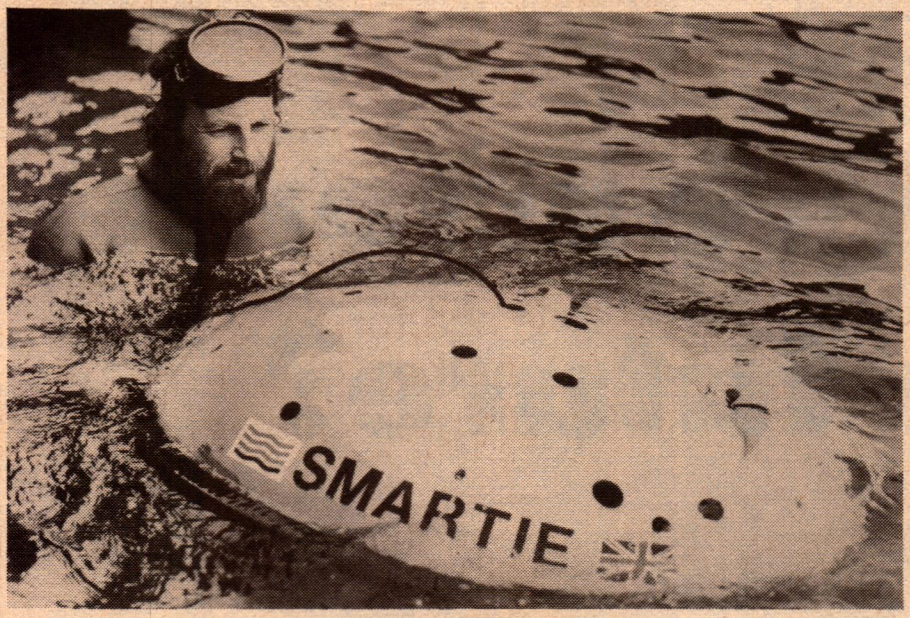
NEWS HIGHLIGHTS

Microcomputer-controlled submersible



A small, unmanned and highly controllable submersible, armed with a battery of television cameras, has been developed in Britain for undersea inspection tasks.

Called "SMARTIE" (Submarine Automatic Remote Television Inspection Equipment), the craft has the shape of a thick disc, is about one metre in diameter, and is driven by directional water jets from an electrically powered pump. It can operate to a depth of 300 metres.

The craft is controlled by its own microcomputer, which interprets manual control signals from a console on the surface. It is supplied with power and control signals by an umbilical cable only 5mm in diameter, with video signals sent over the same cable in the opposite direction. In low visibility, the on-board computer can accept input from the craft's magnetic compass and gyro and can project an artificial navigation "target" that the operator can follow on his screen, even though the craft may be passing through an area of zero visibility.

SMARTIE can be held automatically in any position in fast currents. The operator pushes a "hold" button and the computer compensates for disturbing forces, thus keeping the vehicle in the required position. A similar technique is used to maintain a steady course at speed.

The craft was developed by Martine Unit Technology Ltd, 3 Friars Lane, Richmond, Surrey, England.

Silicon ribbon solar cells

Westinghouse Electric Corporation scientists have announced the achievement of high efficiencies in solar photovoltaic cells made of low cost silicon.

Efficiencies of more than 15 per cent — the theoretical maximum is 22 per cent — have been achieved with silicon dendritic web, a single crystal form of silicon showing high potential for low-cost production, according to Dr. Daniel R. Muss, manager of solid state research and development at Westinghouse's Research and Development Centre in Pittsburgh.

Dr Muss said that the achievement of greater than 15 per cent efficiency is an important milestone in the solar photovoltaic program, in that this is the highest efficiency yet reported for silicon ribbon.

The technique used by Westinghouse forms silicon into a ribbon by drawing the material out of a furnace in a thin strip. The ribbon, or web, is formed by the solidification of a liquid film supported between two silicon filaments called "dendrites".

This process yields a long, mirror-smooth ribbon free from contamination and essentially ready for solar cell fabrication. Thus, unlike other processes, costly slicing, lapping and polishing processes are not required.

Satellite at liberation point

NASA, for the first time, has launched a spacecraft to the Sun-Earth liberation point — that point in space where the gravitational pull of the Sun just balances that of the Earth-Moon system — about 1.6 million kilometres away.

ISEE 3, the third in a series of International Sun Earth Explorer spacecraft, will measure the solar wind constantly emitted by the Sun and other solar phenomena such as sunspots and solar flares, unperturbed by the influence of Earth, while ISEE 1 and 2 — in looping trajectories around the Earth since 1977 — will measure the effect of these phenomena on the near-Earth environment.

The coordinated effort is expected to result in a better understanding of how the Sun controls the Earth's fluctuating near-space environment, and of a variety of solar-terrestrial phenomena, including weather and climate, energy production and ozone depletion in the atmosphere.

One interesting fact about ISEE 3 is that it does not simply "hang" at the liberation point. Instead, the spacecraft has been placed in a "halo" orbit around this point. The orbit has been designed to pass slightly above and below the ecliptic plane (the plane in which all the planets circle the Sun), so as to avoid excessive solar interference with spacecraft communications back to Earth.

Transformer has no coil windings

A miniature transformer which operates without coil windings has been patented by a research institute at Kiev in the Soviet Union.

The new transformer uses a piezoelectric converter instead of a conventional electromagnet. At least two piezoelectric material limbs are secured together to form a "V" or "W", with electrodes chemically deposited on the limbs for the input and output supply. The current fed into one limb causes the limb to vibrate at the input frequency which, in turn, causes the next limb to vibrate in sympathy to produce an output voltage.

The size of the output relative to the input will depend on the relative length of the limbs.

It is claimed that a transformer of the type patented and measuring only 50mm in length can function on a 50Hz mains supply to produce 5000V while consuming only 0.1 watt. Such a transformer would be ideally suited for use in a portable TV set, and in other applications where high voltages are needed and space is at a premium.

Low-risk production of huge amounts of energy — that's the promise of controlled nuclear fusion. Unlike today's fission reactors, a fusion reactor would produce little in the way of radioactive by-products, could not become self-sustaining, and would "fail safe" in the event of a breakdown.

Fusion reactors: in our future?

by MICHAEL BAUM

Baum is a writer and public information specialist in the NBS Public Information Division.

Standing in front of you in a crowded laboratory, the test apparatus takes up a good 100 square metres of floor space and looks like nothing in particular. It's long, flat, and massive, hooked to heavy cables and tubing, and the most noticeable feature is a clear horizontal glass cylinder just over two metres long and 8 centimetres in diameter, the centre third of it clamped with heavy bands of metal.

Two researchers charge the tube with gas and start the firing sequence. The tube suddenly blazes with a brilliant flash of light and a muffled thunderclap is heard.

The light doesn't last long — about four millionths of a second — but during that period you are looking into a model of the heart of a nuclear fusion reactor.

The device is called a *theta pinch*, (see diagram) and William Rowan and James Roberts of the US National Bureau of Standards are using it to study some of the atomic processes that will take place in a fusion reactor. They do this in an ordinary physics laboratory, without ever coming close to starting a nuclear reaction. They do it by an elegant sort of "modelling" in which relatively low temperatures (1,000,000 degrees Celsius) represent unimaginably high temperatures (100,000,000 degrees Celsius) and small, light ions become scale models of large, heavy ions.

Energy from Heavy Hydrogen

The reasons for all this are found in the basic concepts behind fusion research. There are a variety of theoretically possible nuclear fusion reactions in which the nuclei of two light atoms combine to form the nucleus of a heavier atom. The most "popular" reaction — popular because it requires considerably less energy to start than the others — is shown in this equation:

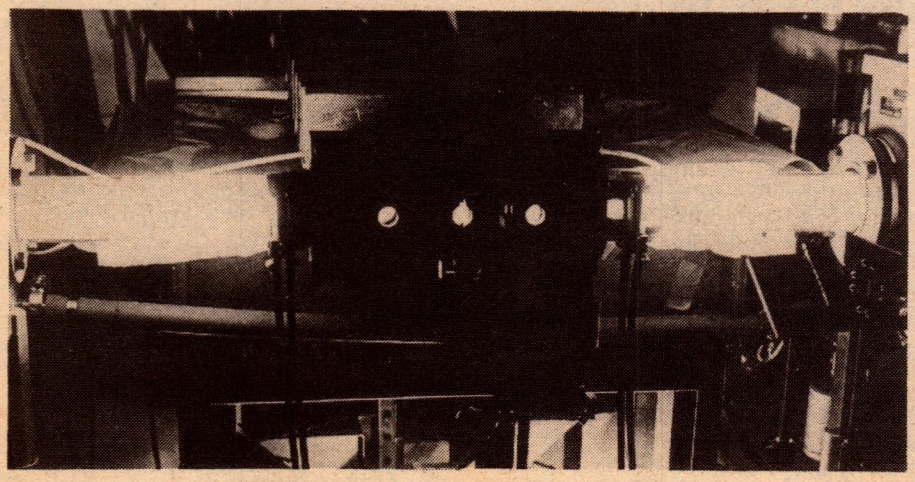
$$D + T \rightarrow {}^{4}He + n + 17.6\ Mev$$

Inherent in this reaction are the advantages and disadvantages common to all fusion processes. This equation begins with deuterium and tritium, the heavy and superheavy isotopes of hydrogen. Fuel for such a reaction is abundant even though there is only about one deuterium atom for every 6500 common hydrogen atoms, because deuterium can be extracted from the Earth's greatest resource — water. The US Department of Energy estimates that the deuterium resources, if used to supply twice the world's current energy demand, would last for about 50 billion years.

Tritium, a radioactive isotope of hydrogen, is not found in nature and therefore has to be manufactured. But the same fusion reactors that burn the tritium can produce it by bombarding lithium with neutron radiation. DOE estimates that *known* lithium reserves would last for almost 50,000 years.

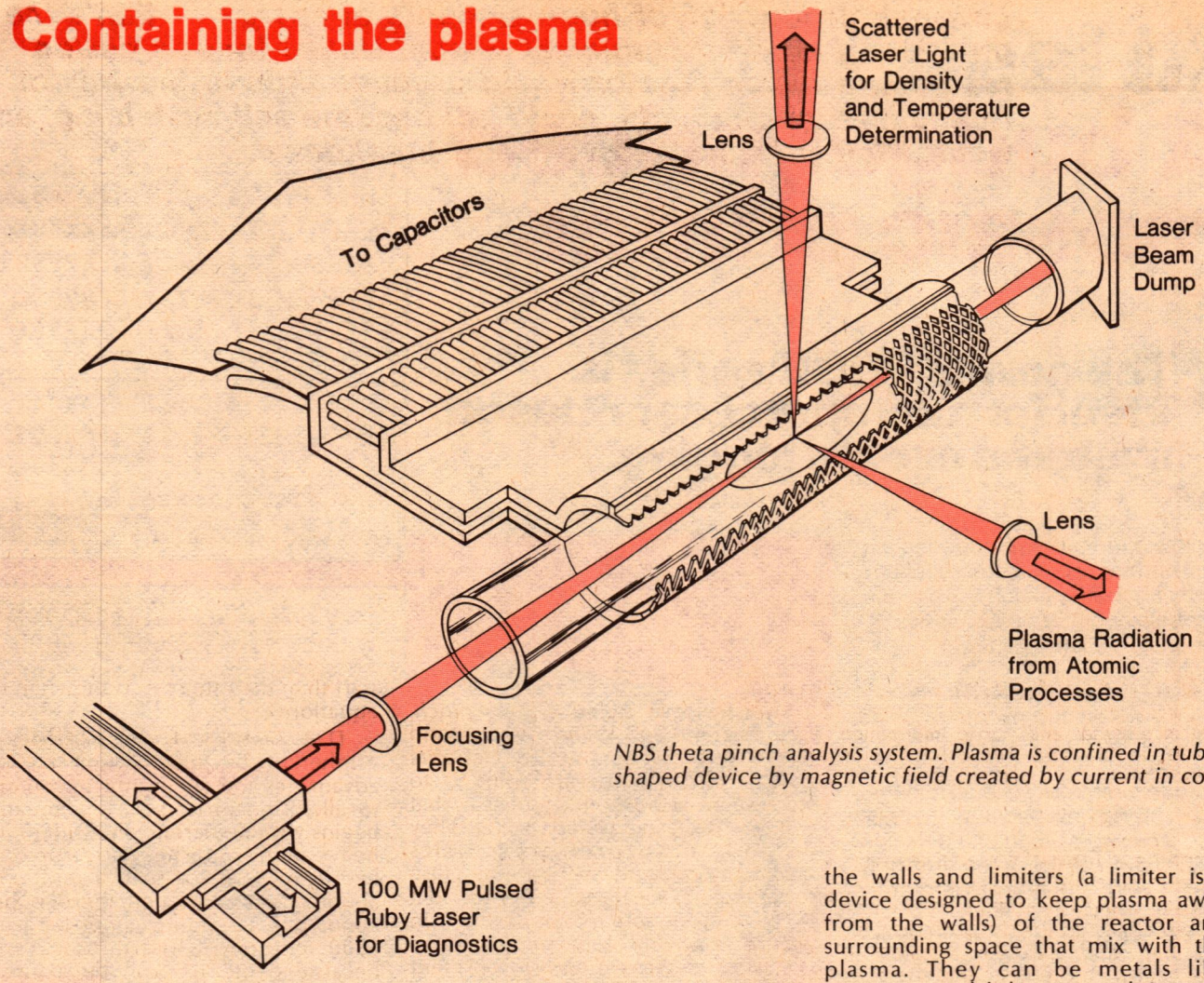
The other side of the equation is equally promising. The main reaction product is common helium, non-polluting and non-radioactive. The reaction produces a great deal of energy, close to 90,000 kilowatt hours per gram of fuel.

The reaction also produces neutron radiation, which in turn produces radiation in the materials used to build the reactor. However, by selecting



Brilliant light fills a theta pinch reaction chamber at NBS as the rising magnetic field heats hydrogen plasma to 1 million degrees Celsius for 4 millionths of a second.

Containing the plasma



NBS theta pinch analysis system. Plasma is confined in tube-shaped device by magnetic field created by current in coil.

those materials carefully, the radiation hazard can be kept to a minimum.

For two reasons, fusion reactors would theoretically be many times safer than the fission reactors in operation today. First, the amounts of radioactive materials on hand in a fusion reactor are comparatively small. Second, the fusion process in a reactor cannot become self-sustaining. If the system inducing the process failed to operate properly, the reaction itself would "fail safe" simply by stopping.

Fusion looks like the rosy alternative on the basis of these comparisons, but there are other elements to consider before the picture is complete. For instance, power from fission reactors is today lighting up homes, businesses, and industries in various countries. A fusion reactor has never lit a single bulb anywhere in the world. And there's the rub.

How to Make It Work

The biggest problem with a fusion reactor is how to make it work. Some technical experts doubt that it's possible to do so. The NBS theta pinch project is designed to help find out.

The extreme conditions that must be achieved and maintained pose formidable difficulties, according to Roberts, chief of the NBS theta pinch project.

In the ionized gas or *plasma,* which forms the fuel for the magnetic fusion reactor, the deuterium and tritium nuclei both carry electrical charges which tend to keep them apart. For the particles to fuse and ignite the fusion reaction, they must have a high kinetic energy (that is, be very hot) and be kept packed together for a sufficient length of time.

The deuterium-tritium reaction has by far the lowest "ignition temperature" of the fusion reactions possible in a reactor, but even this reaction takes place at temperatures of approximately 100 million degrees Celsius or more. Think of that as comparable to the temperatures in the centre of the Sun.

"But reaching the temperature is only part of the problem," says Roberts. "Serious considerations like radiated power losses from impurities, diffusion, and instabilities must be addressed."

Diffusion and instabilities refer to the inability of the confining magnetic field to hold the plasma together (see diagrams). Impurities are another matter.

Impurities are free atoms torn from the walls and limiters (a limiter is a device designed to keep plasma away from the walls) of the reactor and surrounding space that mix with the plasma. They can be metals like tungsten, molybdenum, and iron or gases, including oxygen. Impurities in the plasma are a crucial problem in designing fusion reactors.

Why? "The impurities enter the plasma, soak up energy, and radiate it by the emission of light energy. This reduces the thermal kinetic (heat) energy of the particles, which is what we need to produce fusion," explains Roberts. "With high Z (Z being atomic number) impurities, such as the heavier metals from the walls and limiters of fusion devices, it takes more energy to ionize them — to strip them of electrons."

In addition, he says, "A large amount of energy goes to the remaining electrons in the heavy impurity atoms which can change temporarily to high energy states, return to their "ground" state, and give off the energy they've acquired by emission of light. That would be okay if the energy were given back to the plasma, but it's not. It's radiated as ordinary light."

Data to Build On

This is where the theta pinch comes in. "Basically what we're doing is providing atomic data to the fusion energy community — the people doing fusion research — so that they can better understand the dynamics of the plasmas," says Roberts. The project is

At last:
A budget-priced mosaic printer.

The new EUYIOE series is ideal for microprocessor-based systems or data logging.

How often have you needed a small printer which can produce many characters, alpha-numerals, symbols and graphs at 2 lines per second on 60 mm paper?

Matsushita's new quiet non-impact Electrosensitive Printers use a 7 x 5 dot matrix and a choice of characters per line (15, 21, 32 or 40).

Added versatility is built into the EUY10E models because there is also a choice of scanning direction.

Even with all these features only a low 24 volts is needed to operate the units.

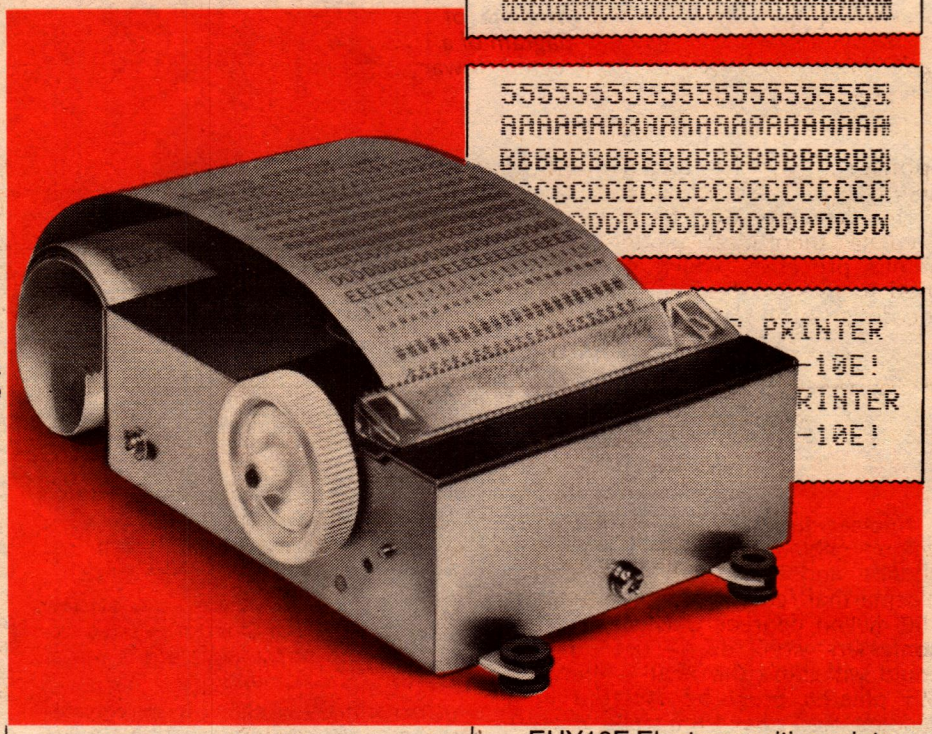
Due to low power consumption, it can operate on batteries with converters.

One motor drives both the printing head and recording paper through a dependable mangle gear. Special overall design reduces the number of parts needed and the natural result is less weight, smaller size and most important, greater reliability.

Choice of drive units.

To drive the EUY10E printer you have the choice of two interface units. EUYPUD022A is a basic drive unit which provides signals to power the motor and printing head. It offers the user maximum versatility and flexibility. EUYPUD024C is designed to interface between the printer and microprocessor kits such as 2650KT9500, SC/MP or D2.

The EUYPUD024C contains a full 64 ASCII character generator.



Specifications	
Printing method	Electrosensitive
No. of characters per line	15, 21, 32, 40
Types of characters	Alpha-numeral, symbol, graph
Character composition	7 x 5 dot matrix
Printing speed	Approx. 2 lines/sec.
Character height	2.4 ± 0.2 mm (0.094" ± 0.008")
Input voltage	−24V ± 5%
Current	300mA
Life	MCBF 1 x 10^6 lines
Dimensions	90.5(W) x 110(D) x 42.5(H) mm 3.56(W) x 4.33(D) x 1.67(H) inch
Weight (approx:)	370 g (0.814 lb)

EUY10E Electrosensitive printers have all the features you need, at a price that makes them even more attractive.

You can purchase your EUY10E and interface from your local distributor of Philips components.

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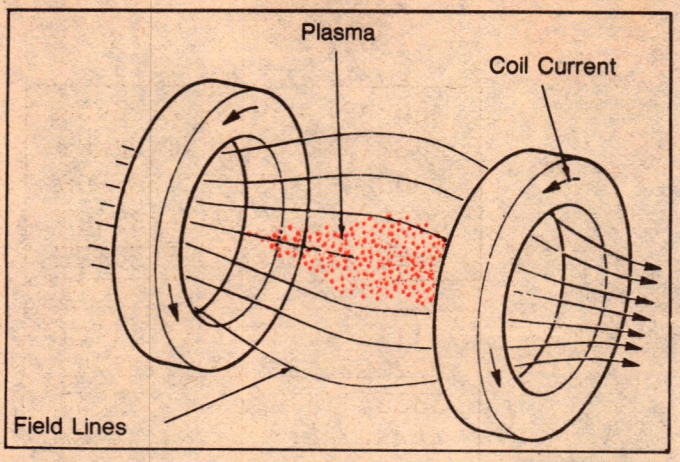
Fusion reactors: in our future?



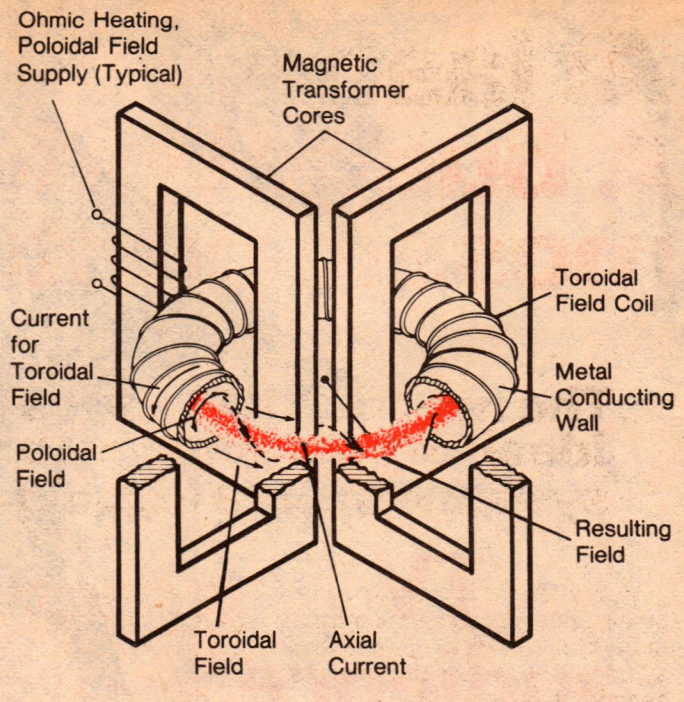


Diagram at top illustrates the principle of the magnetic mirror system, while at right is a diagram of a Tokamak. The bulk of fusion research is directed towards Tokamak devices.

sponsored by the Department of Energy.

The data are used to make more accurate theoretical models of the atomic processes, which in turn are used to make critical decisions about the design of the reactors — decisions such as what metals should be used to build the walls and limiters that will confine the plasma. To the people who are trying to develop fusion devices in places like the Princeton Plasma Physics Laboratory, Oak Ridge National Laboratory, and the Massachusetts Institute of Technology, the atomic scale models have a value many times their size.

Reprinted from "Dimensions", journal of the National Bureau of Standards, Washington, DC.

Plasma confinement techniques . . .

Nuclear fusion reactors present a unique engineering problem: how to confine and heat a charged gas or plasma that reaches a temperature of 100 million degrees Celsius. Ordinary containers won't do — even if they could withstand the heat — because the plasma must be isolated in a vacuum, well away from walls or other structures that would cool it.

Current fusion research is investigating two separate ways of solving this problem. Inertial confinement, such as is being explored with the SHIVA laser at Lawrence Livermore Laboratory, uses fuel contained in small hollow spheres ("microballoons") which are burned and imploded one at a time by high energy laser beams. Each microballoon is heated so quickly that the expanding gas from the outside compresses and heats the remaining core to reaction conditions — the fuel becomes essentially its own container.

Magnetic confinement, more highly developed, uses invisible walls of magnetic force to hold the plasma while it is heated to reaction temperature. Magnetic confinement systems would hold the fuel at a much lower density than inertial confinement systems, and for a much longer time (approximately one second for a test reactor, compared to 10^{-9} seconds).

The theta pinch device at the National Bureau of Standards is an example of one of the simplest types of magnetic confinement.

Although they can be doughnut-shaped, typical theta pinch instruments are simply long tube-shaped devices ringed by a single-turn current carrying coil. Since the gas which forms the fuel for a theta pinch is ionized — each particle carries an electric charge — it can be restrained by the tube-shaped magnetic field, which creates a kind of "bottle".

Once confined, the plasma has to be heated. Since the charged particles will carry an electric current, electrical induction (using the "theta pinch" coil to set up an electric current in the plasma) is a common heating technique. Theta pinch devices heat the plasma by a sudden, powerful increase in the magnetic field strength which squeezes the plasma in on itself, simultaneously increasing the density and raising the temperature. This "pinch" effect is the origin of the name.

Squeezing the plasma tends to force it out the ends of the tube, lowering the density and temperature. This problem, called diffusion, is partially solved by another confinement scheme: the magnetic mirror, which is also generally tube-shaped, but includes magnets of much greater power at the ends of the tube. These squeeze the ends of the plasma region together and tend to reflect the charged particles back along the tube.

Magnetic mirrors are more popular than theta pinches for actual reactor designs, but a still more popular design is the Tokamak, a name which comes from the Russian acronym for toroidal magnetic chamber. Tokamaks use toroidal or doughnut-shaped magnetic fields with no open ends. This design offers a number of advantages in controlling diffusion and accounts for the fact that the bulk of fusion research is directed towards Tokamak devices.

Both Tokamaks and magnetic mirrors commonly heat their fuel by induction; by bombarding the plasma with high energy, high frequency radio waves; by injecting into the plasma a stream of high energy neutral hydrogen atoms (neutral beam heating); or by some combinations of the three.

TV audience talks back!

The soap powder commercial is terrible. Imagine being able to press the "zap" button on a small table-top unit to register your protest at a central monitoring station!

Television sets in American homes are turned on an average of six to seven hours a day. Yet no one knows how many are actually being watched at any one time, or how the viewers are reacting moment to moment to the programs they do watch.

The powerful Nielson ratings are established by the viewing habits of 1200 metered homes, supplemented by an additional panel who keep written records of the programs they watch.

Even the viewers in the metered homes have no way of immediately registering their opinions of what they see, other than by changing channels or turning their sets off.

Now R. D. Percy & Company in Seattle, Washington is moving to supply this missing audience feedback using a system designed by SRI (Stanford Research Institute) International researchers.

Moment-to-moment monitoring

For the past 18 months, the system has been monitoring the moment-to-moment reactions of a panel of 32 randomly selected TV viewers in the Seattle area. Currently the panel is being expanded to 200 Seattle families — approaching the size of the Nielson metered panel of 230 in the Chicago area.

The heart of the SRI-developed system is a remote-controlled device connected to the viewer's television set. By pushing buttons on this device, the viewer can express a variety of reactions to the program.

These reactions are translated to digital code and transmitted instantaneously to the Percy offices, where they can be stored for future use or displayed on computer printout or video screen.

There are six buttons on the monitoring device. One is marked "applause". Another is marked "more" — to indicate that the viewer wants more information about the product or subject being discussed.

There is a button to press if something is funny; another if the viewer agrees with what is being said; another if he doesn't believe it. Strong disapproval calls for the "zap" button, which turns off both sound and picture for as long as it is depressed!

According to Percy, the next generation of devices will contain four more buttons and a dial that will identify which family member is watching the set.

Watching viewers' reactions

Researchers in the Percy office can view panel members' reactions on a TV monitor in "real time" — as fast as the viewers push the various buttons. For example, if 10 per cent of the panel members who are tuned into a particular channel push the "applause" button at the same time, a light appears behind the letters "App" on the TV monitor and a bar graph measures 10 per cent (see photo).

Thus the lights and the bar graph reflect moment-to-moment changes in response as the program moves along.

Among the system's capabilities are the following:

- It is operational 24 hours a day, seven days a week.
- The device can be installed in a few minutes on any television set, whether cable or not.
- All channels being broadcast can be monitored simultaneously.
- Viewer responses can be attributed to each household and, in the newer devices, to each family member.

Even with the current devices, says R.D. Percy, president of the company, it is easy to tell from a viewer's response whether he or she is an adult or a child.

"Children have a different sense of humour from yours or mine," he points out. "For example, to a nine-year-old, underwear is hysterical."

At the present time, says Percy, the prime use of the feedback data collected by the system is for evaluating the effectiveness of advertising.

"We can find out whether an ad has stronger impact on one show or another or in the daytime or prime evening hours," he says, "and we can document our findings with computer printouts and videotapes comparing the actual viewer responses at different times."

Sometimes an ad that attracts favourable attention when it first appears ends either by being ignored or by grating on people's nerves so much that it actually kills sales. The feedback system can document this progressive wearout of a campaign.

The Percy people have their own system for tracking television advertising. Thus they can study competitive impact and exposure levels simultaneously for all products and services advertised.

According to Percy, two companies that are experimenting with the audience feedback information for evaluating advertising are General Foods Corporation and Sears Roebuck and Co.

Evaluating programs

The system is also being used to evaluate programming. For example, a preview of a Public Broadcasting System (PBS) program on the drought was monitored recently. A videtape of the audience response showed that the program was basically popular but that the audience found certain repetitive portions boring.

As a result, PBS aired an edited version nationally and requested Percy & Company to monitor all its programs for 1978-79.

Audience reactions to current events and political speeches are also being monitored. Percy & Company has followed public response in the Seattle area to the energy issue for the past 15 months, documenting a 77 per cent decline in public interest in this subject.

Monitoring a recent Carter speech, the company was able, overnight, to prepare a 15-page report on audience reactions, backed up by computer printout and videotape.

Even based on a tiny sample of 32 families, this report mirrored the results of the Roper organization on the same speech published three days later.

The "least objectionable" program

A fourth area of research made possible by the system is the study of general behaviour toward TV.

There is a theory, says Percy, that instead of actively choosing a particular program on TV, most people make the decision to "watch TV tonight". Then they switch about from one channel to another trying to find what researchers call the "least objectionable" program.

The viewing habits of the Percy & Company panel members tend to confirm this theory, he says, adding that, insofar as possible, these families represent a cross-section of TV viewers.

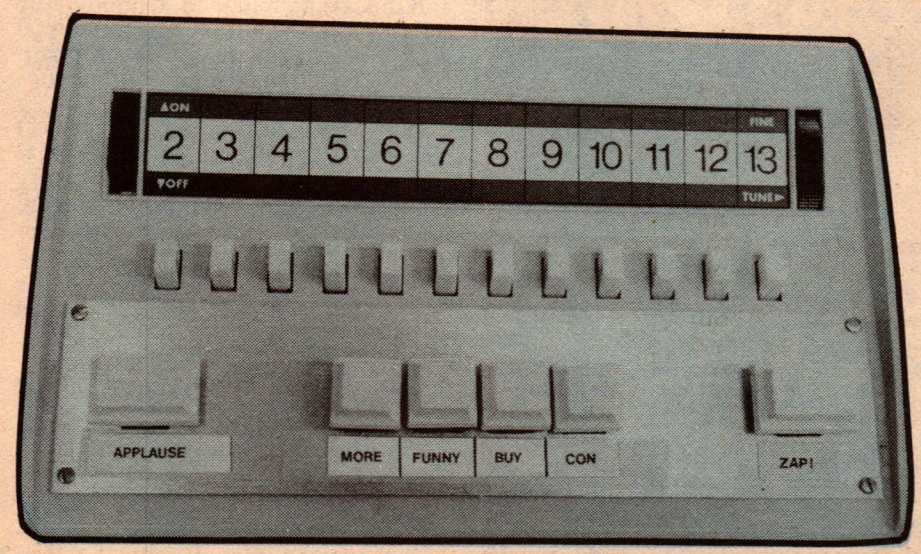
The original 32 were selected by random sampling more than 500 families in the Seattle area. Special-interest groups are represented only in proportion to their numbers in the general population.

Although the so-called "silent majority" of TV viewers tend to be passive in their viewing habits, Percy says he has found that his panel members welcome the opportunity to play a more active role in the process.

Although no one is paid to participate in the program, he says, there is steady audience feedback.

After being panel members even for a short time, he notes, people get so used to being able to "talk back" that many report feeling frustrated when they watch a TV set without a response device.

Reprinted from "Investments in Tomorrow", by arrangement with SRI International, Menlo Park, California.



This monitoring device allows viewers to express their opinions on TV programs. These opinions are registered on a TV screen at the monitoring station.

Telecom opens $10m research complex

Rapidly changing electronics technology presents any country with a challenge to ensure that its communications links remain viable and up-do-date. Telecom Australia has responded to the challenge by building a new research laboratory complex at Clayton, Victoria.

The $9.8 million first stage of Telecom's new Research Laboratories at Clayton (a suburb of Melbourne) were officially opened last June by the Minister for Post and Telecommunications, Mr A. A. Staley, MP. At the opening, Mr Staley congratulated all concerned with the project. The design, he said, would help provide the most modern communications to meet the social, commercial and industrial needs of Australians as economically as possible.

The new laboratories provide accommodation for 200 of the P&T Commission's 500 research staff, and represent the first step in a continuing program to centralise research activities.

Since the establishment of the Research Laboratories in 1923, the provision of building accommodation has followed an ad hoc pattern of leasing buildings in the Melbourne city area. At one stage, seven buildings at the eastern end of Melbourne plus one building in North Carlton were in use by the Laboratories.

These buildings were old, having been erected as factories or warehouses, and required considerable refurbishing and continual maintenance to keep them at a suitable standard for specialist laboratory work. A major problem was the provision of building services to meet the changing needs of a developing technology.

In the late 1960s the then Australian Post Office undertook a comprehensive review of its Research Laboratories' accommodation needs. It was agreed that the leased accommodation was unsatisfactory and it was recommended that the Laboratories should be consolidated in new, specially designed buildings located well away from the Central Business District.

This culminated with the purchase, in 1972, of a seven hectare site in Blackburn Road, Clayton, near Monash University. Subsequently, a further 12 hectares adjoining the first site was purchased for long term development.

Parliamentary approval to proceed with construction of the first stage of development was received in November 1973. The project subsequently became known as the Monash Laboratories project.

The decision to develop a new Laboratories complex in the Clayton area was based on the economics of providing specialised laboratory buildings in a long term multi-staged expansion program. Feasibility studies conducted by the then Department of Works concluded that the most cost effective design would result from the establishment of a number of low rise buildings in a campus-style setting on a large block of land.

This arrangement made it possible to spread the development of the project over a number of years and required relatively small but regular funds commitments, compared to a large single investment for one high-rise building.

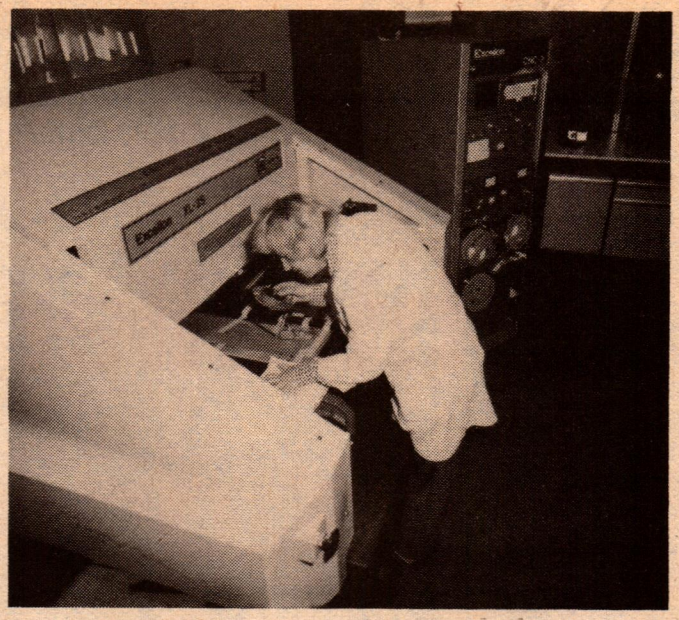
Land suited to this style of building was only available in the suburban area and this, combined with the popularity of the eastern suburbs as a residential area, and its proximity to the Monash University, led to the choice of the present site.

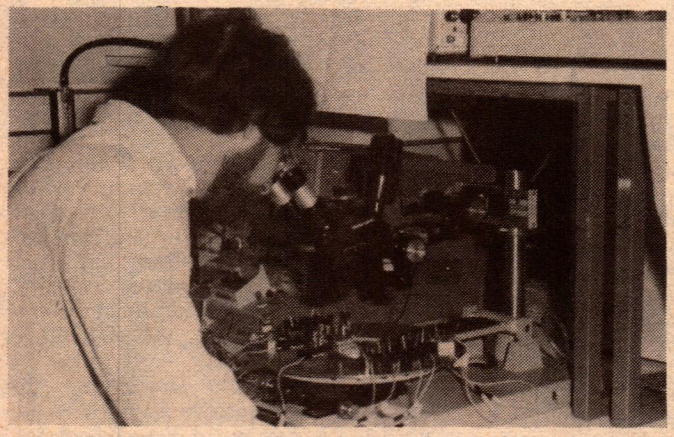
The Monash Laboratories project currently comprises one single story and two three storey laboratory buildings designed to accommodate some 200 staff; a single storey plant building; and a gatehouse. The buildings function as follows:

- Building 1 — houses the Physical Sciences Branch and the Microelectronics Section;
- Building 2 — houses parts of the Advanced Techniques and the Standards & Laboratories Engineering Branches, the Laboratories Executive and Administrative staff, Cafeteria and Library;
- Building 3 — houses the Environmental Physics activity; and
- Building 4 — accommodates centralised mechanical and electrical

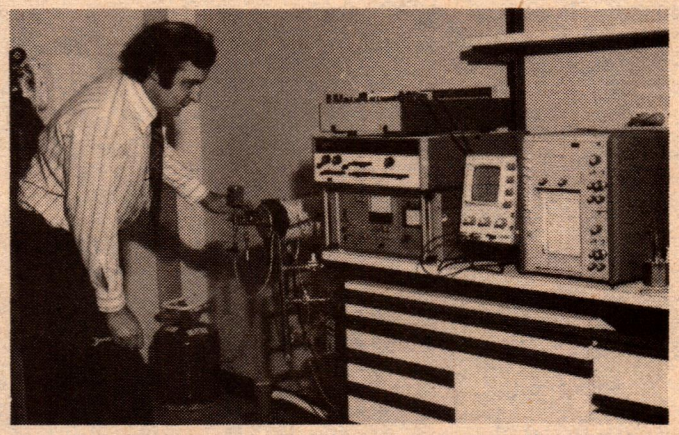
Mr Staley showed great interest in this advanced micro-welder which joins very thin metals. Showing him the technique is senior fitter and turner Neil McKenzie.

Above: Labs staffer Cheryl Crarey indicates the control panel of a bank of furnaces which fire thick film conductors at temperatures up to 850°C. View at right shows Tech. Assistant Eta Horvath setting up the Lab's new $70,000 numerically controlled machine which automatically — and accurately — drills holes in printed circuit boards for telephone exchanges.





Above: TO2 Fred Gigliotti tests micro circuits in the new Thick Film Laboratory. At right, chemist Bob Western operates a mass spectrometer to test gold plated relays which are replacing exposed mechanical switches in telephone exchanges. The reeds are bomarded with helium and any leakage detected means a defective reed.



plant for the building services systems.

Buildings 1 and 3 are connected by a single storey laboratory and office link to form an integrated structure.

The buildings conform to an overall master plan as a group of several low rise (up to three storey) buildings arranged in a campus-style configuration linked by garden courts. This approach allows the necessary flexibility for further stages to accommodate those sections which are still in the City and at Winterton Road, Clayton.

A feature of the modular design of the buildings is the ease with which laboratory needs may be altered in both size and function, and the practicality of converting offices into laboratory space.

The three-storey laboratory buildings are constructed of reinforced concrete columns and floors with concrete block panel walls. Reinforced concrete has been used around stairs, lifts and service ducts to ensure lateral stability. Mechanical plant is located within the roof space.

The single storey buildings are steel framed with concrete block external walls. The roofs of all buildings are sheeted with corrugated aluminium, while facias and ducts are clad with prefinished steel sheeting. Windows are of anodised aluminium, fitted with reflective double glass to reduce solar heat build-up.

Air conditioning is provided to all laboratories, offices, cafeteria and amenities rooms to ensure maximum comfort.

The buildings incorporate amenities in accordance with the Commonwealth Amenities Code which applied at the time of their design. These include a temporary cafeteria (Ground Floor, Building 2) to seat approximately 120 people, active and passive recreation rooms, showers and tea-making facilities.

The second stage of development will provide three buildings to accommodate sections currently in the city; Electrical Standards, Time & Frequency Standards, Laboratory Instrumentation and Customer Apparatus. Further facilities will be provided for an enlarged cafeteria, main library, etc. Documentation is now well advanced and completion is expected by 1982. A further stage will then be considered for those sections currently at Winterton Road, Clayton.

Reprinted from "Telecom", house journal of Telecom Australia.

Whatever the layout of your model railroad, it's about to become obsolete. Hornby Railways of England has developed a new multi-train control system which it says will bring a substantial advance in operational realism.

Controller runs 16 trains on one track

The secretary swears that it's true . . . she entered the office of one of industry's leaders and, not realising that he was no longer alone, this top executive was gazing at the newly acquired model railway engine on his blotter and saying "choof choof" to it!

But whether small boys or top industrial executives, all model railroading enthusiasts are about to have one thing in common — their model train layouts are about to re rendered obsolete by a new electronic model railway control system recently unveiled by Hornby Railways in England.

Called "Zero One", Hornby's new train controller is built around a microcomputer. A highly advanced system, it will eventually permit control not only of locomotives but also of points and colour light signals, as well as offering inertia control and a range of realistic sound effects.

No longer will you have to say "choof, choof" to your model trains!!

Zero One was designed by Hornby engineer Lucien d'Sa, who says there's no other system like it. Up until now, the problem has been that in order to control more than one locomotive on a model train system, you had to divide the track into insulated sections. Each section was then connected to an independent control unit and the locomotives operated by controlling the power fed to the various sections.

Even a modest layout soon became a nightmare of wiring and switches, and the system placed severe limitations on the number of locomotives that could be controlled.

With the Zero One system, on the other hand, power control takes place in the locomotive and not via the rails. The system allows up to 16 locomotives to be on the track, any of which can be "called up" and controlled by the master control unit. The addition of one or two slave control units alongside the master control unit permits two or three locomotives to be controlled entirely independently and simultaneously — or in computer jargon, "real-time control".

An essential component of Zero One is the miniature control module which can be fitted quite simply to the majority of Hornby locomotives. The modules have three colour-coded leads and connect between the motor and pick-ups. A switch on the module allows the modeller to assign any one of 16 codes to the locomotive.

Once the module is installed, the locomotive is registered as, for example, 01, 02 etc, and will respond only when its particular code is tapped out on the master control unit's keyboard. A locomotive's code may be altered at any time simply by changing the switch setting.

Hornby claim that Zero One will bring a substantial advance in operational realism. Even on small layouts, the traditional need to isolate sections of the track to perform such operations as shunting represents an undoubted handicap. It is worth noting too that, with Zero One, coach lights and the illuminated head codes of locomotives will remain at full brilliance at any speed, even when the trains are stationary.

Phase one of the Zero One system, scheduled for release in Britain towards the end of 1979, will offer locomotive control with selected levels of inertia. Phase two, available about a year later, will bring computer control of points and signals, while phase three will provide the sound effects and automatic program facility.

There is no information as to when the system will be available in Australia.

Artist's concept of Hornby's Zero One model train controller. View shows the master control unit together with one of the slave control units.

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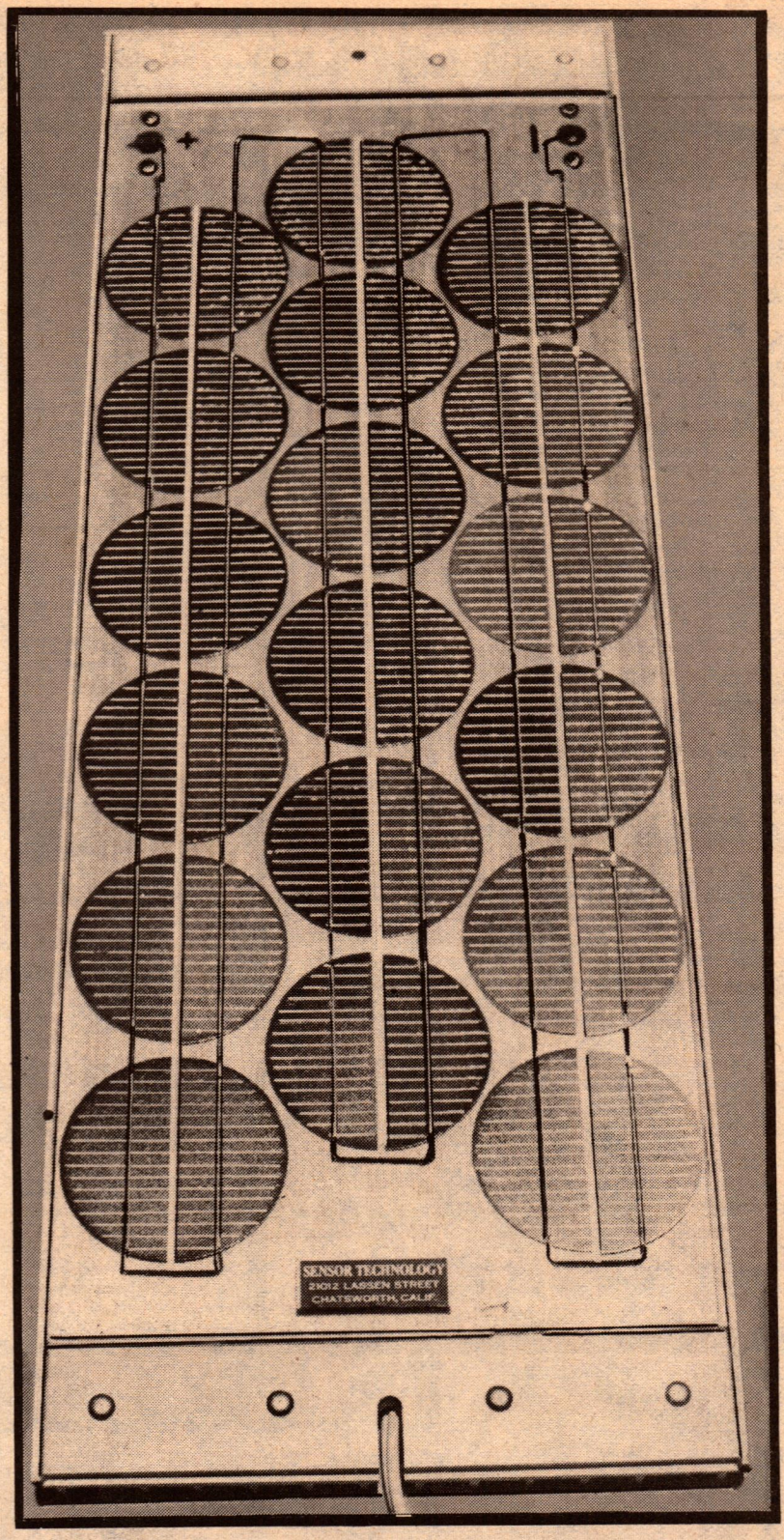

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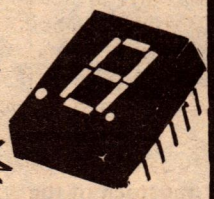

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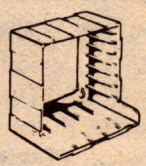

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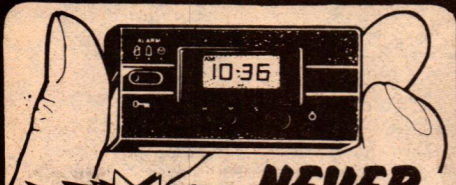

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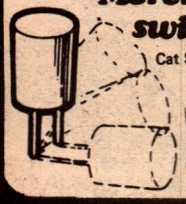

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Please check with our stores for latest availability and prices.

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Fully built audio modulator ..... Cat. K-6042 ... $4.50
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Forum

Conducted by Neville Williams

Peter O'Neill and the Metric System: We stand accused and plead guilty

Easily the longest letter in our mail for the month was one from a reader in South Australia, who protested bitterly about an article on "Electronics and the Metric System" in the July issue. Having dismissed such articles as "pontifications to be devoutly disseminated to the masses by the subservient media" he proceeded to set out in detail his own strongly held anti-metric views.

I read the letter, as did Editor Jim Rowe, and we discussed at some length whether we would publish it. Ultimately we decided against so doing, not because we are censors at heart, or disciples of metrication, but simply as an exercise in editorial discretion.

If this sounds sinister, I hasten to add that, implicit in every issue of the magazine there are many, maybe dozens of such decisions: what goes in, and what stays out. As a matter of course, we cull through all the material on hand and fill the available space with what we believe to be most pertinent at the particular time.

In the case of the letter in question, our reactions could be summed up as follows:

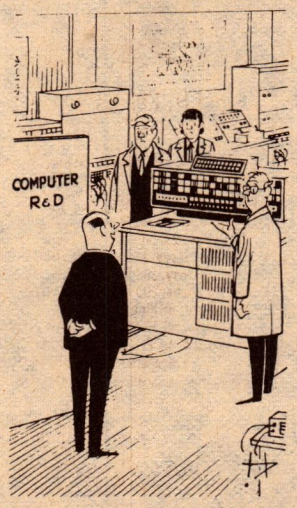
- By and large, its contents had all been expressed before, by many people in many places. Readers other than dedicated antagonists or protagonists would most likely find its further repetition tedious.
- A great deal of anti/pro metric argument, involving currency, weights and measures, has nothing directly to do with electronics, however significant the personal and social implications.
- The publication of a couple of pages of anti-metric material would be the signal for a spate of non-electronic correspondence, thereby compounding the problem.
- Most of the correspondence so generated would be at a superficial, even emotional level. While many may feel strongly about the subject, few (me included) really have the background or the resources adequately to equate short-term disadvantages with long-term benefits.

And that's really what it's all about.

Those are basic editorial reasons, which would have applied just as forcibly had the correspondent been a champion of the cause. That, too, has all been said before!

Our reasons for publishing the original article by Peter O'Neill were essentially pragmatic.

Like it or not, Australia, along with many other nations, has officially opted for the Metric system as the most effective way of rationalising the hotchpotch of weights and measures around the world. We simply feel that it is constructive to aid, rather than frustrate, moves towards international standardisation.



"It's our new Imperial model. It converts frequency in Kilohertz to wavelength in rods, poles or perches!" (With acknowledgement to "Electronics Weekly").

And, of course, Peter O'Neill's article dealt primarily with a branch of technology which is of sufficiently recent origin to have world-standard units and world-standard decimal derivatives. What a bind if we had to convert Australian conventions to those of other countries before we could compare potential, current, resistance, &c!

Is it any less a bind, having to convert other quantities involved in just about everything else we do? May not the effort be worthwhile, in the long run, to achieve international standards overall?

To be sure, even those of us accustomed to decimals have suffered some confusion with the changed units but the fact is that we do fairly soon acquire a familiarity with those we actually use. And the more complete the change, the more shortlived is the trauma.

A few years ago, the page sizes, picture sizes and column dimensions in this magazine were all expressed in inches and fractions of inches. At the suggested time for the printing industry, we changed over to metric measure. There's no way now that anyone on our staff would want to revert to inches and fractions which, by comparison, are clumsy to use, or express or to set in type. Quite automatically we think and work in millimetres or centrimetres as appropriate. (yes, centimetres!)

But, while saying this, I must agree with criticis of the Metric system (S.I.) that some of its conventions are based on curious logic and that this shows through in the pronouncements of the local Metrication Conversion Board. However, I do not see this as a reason to reject the whole concept out of hand. Rather would I hope that useage and commonsense will obviate some of the apparent inconsistencies — or make us less conscious of them!

PRINTING PROBLEMS

If I might get away from the original "some people hate metric" theme, Peter O'Neill's article did highlight a quite different problem which faces any journal carrying technical material, which is typeset on ordinary newspaper/magazine facilities. On the plus side is a good selection of type faces, speed and economy; on the minus side is the difficulty of inserting Greek letters, superior and inferior characters, and other than simple mathematical symbols.

They can be physically added to the typeset material as, indeed, some of them were for Peter O'Neill's article — as a matter of necessity. But there was, and is, a penalty: every non-standard symbol frustrates the flow of highly organised and automated procedures and becomes a significant component in overall setting and make-up costs. We avoid them wherever possible.

For example, the MCB prefers, and technical writers expect, that the Greek letter "mu" should be used as an abbreviation for "micro". Unfortunately, it is not available on normal photosetting discs or keyboards and so, in an effort to contain production costs, we substitute the English letter "u", as in uF, uH, uA, &c. It so happens that the MCB concedes that this liberty may have to be taken — along with a few others.

However, the Board is not so flexible when it suggests: "a thin space should be left between number and unit symbol: 20 A NOT 20A".

There are two problems here. The first is that a normal computer controlled typesetter has no provision for a thing called "a thin space". The keyboard operator can only group letters close-up (as in a word) or spaced (as between words). If the latter, then the computer can expand those spaces as necessary in the process of "-justifying" the line — i.e., making the line fill the full column width. What ideally should be a "thin space" may easily turn out to be a rather unsightly thick space!

(Note what the computer did with the word "justifying" in the above paragraph).

The second problem follows on. It is the computer which decides how many words will fit into each line and it does this in accordance with inbuilt instructions involving vowels, consonants, punctuation marks, spaces, etc. If it encounters spaced characters such as 20 A, it will regard them as individual words, which may legitimately be separated, with the 20 on the end of one line and the A on the beginning of the next.

If one obeys the further rule "A.h. NOT Ah" the hazard is increased. Thus the expression 20 A.h has two chances of being broken up, with part of it on one line and the rest of it on the next. By setting it simply as 20Ah, the computer treats it as a word, to be accommodated as such, if at all possible.

The fact of the matter is that, if one insists on using conventions which are likely to produce an odd result, and also insists that each and every odd result be fixed when it occurs, then one must expect a higher typesetting charge. That this could be significant is confirmed by our printing contractors.

When it forms part of cleanly presented, plain language text, the time component in a single paragraph of an article like this is quite short, maybe a couple of minutes.

But if the computer produces an unacceptable line turnover, it is rejected by the proof readers and returned to the keyboard operator. As a special job, he has to re-set a group of lines, or the whole paragraph, with manual intervention to prevent the computer from merely repeating its original "error". The tape is then fed into the photosetter, the bromide recovered

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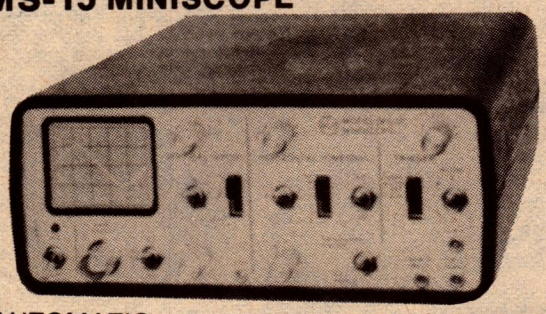

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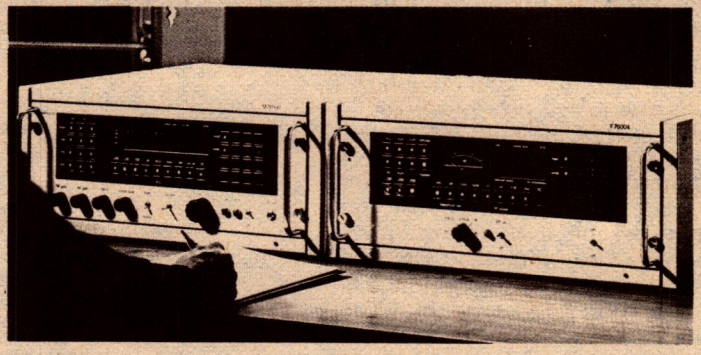

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Automatic:
An increase in input level of 120 dB above 2μV emf will produce a change in output of less than 4 dB

Frequency Range:
10 kHz to 30 MHz

Frequency Setting:
Frequency is selected via a digital keyboard. In addition, the frequency selected can be increased or decreased in steps of 100 Hz at variable speed for searching, using a single knob. A clarifier control provides fine tuning in steps of 5 Hz.
Option:
MEM064: Memory for 64 frequencies with corresponding modes

Sensitivity:
20 dB SINAD for 1μV input from 1.6 MHz to 30 MHz. Reduced below 1.6 MHz.

Selectivity:
A3A, A3J, A3B:
Pass band, –3 dB: 250 Hz to 3000 Hz

Intermodulation:
90 dBμV per signal produces equivalent input signal of 30 dBμV

Options:
Pass band, –6 dB: 350 Hz to 2700 Hz
or
Pass band, –3 dB: 250 Hz to 6000 Hz
A1, A2, A3, A2H, A3H, F1:
"Very narrow": 0.2 kHz - 6 dB
"Narrow": 1 kHz - 6 dB
"Intermediate": 3 kHz - 6 dB
"Wide": 8 kHz - 6 dB
Other filters on special order
Input Impedance:
50 ohms above 1.6 MHz

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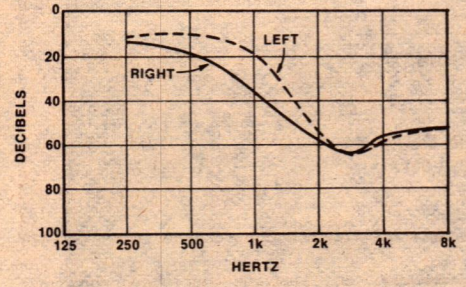
Dannebrog Elektronik AS

FORUM — continued

and re-read, and passed on to the compositor to be substituted for the reject paragraph. The disruption to routines may add several minutes to the time component of every paragraph so affected.

If one is in the publishing business, with the need to balance the budget, one does not lightly invite this kind of complication, by adding spaces and full points which are not strictly necessary to preserve the sense.

So, if you notice that some of our conventions are not in line with Peter O'Neill and his MCB, or with your favourite set of standards, it is not simply because we are being stubborn or hard to get on with. It is more likely that, in a choice between efficiency and pedantry, we sometimes favour the former!



To change the subject to something at a more personal level, recent discussion about hearing problems has prompted a letter from a Victorian reader, who is anxious to offer what encouragement he can. He has this to say:

Dear Mr Williams,

As a reader of many years standing, I read with great interest your discussion on hearing problems and aids. Perhaps my personal experience might assist some other reader.

For many years, I complained that people spoke too softly or indistinctly to me. My wife, bless her, finally induced me to have a hearing test. I found that I had nerve deafness. I was then 56 years old; I am now 64.

An aid helped considerably and I still remember my first visit to the country after it was fitted. I could hear insects and birds again! I still had some difficulty with conversations in noisy situations, but not to the same degree.

The aid had the usual volume control, a preset tone control and a clipping device which could be also preset. This I found of doubtful value as it introduced distortion.

Over the years my hearing deteriorated and I found it increasingly difficut to cope with social and business situations. I am a counsellor in a youth group and am associated with elderly citizens homes and church groups.

I approached a consultant who kindly allowed me to try several aids. I settled on one which has overcome most of my problems. It has an electret microphone, AVC, the usual volume control, and also has an overall gain control which can be adjusted to the individual.

In noisy areas I am now reasonably comfortable, the AVC takes care of that and clarity is astonishing compared with my previous aid, perhaps due in part to the mic. I tried an aid with compression, but this, I found, reduced clarity. I transferred my old aid to my other ear and use it for extra boost at lectures, etc.

My aid is switched on when I arise in the morning until I go to bed (about 16 hours) and consumes one 675 battery in 10 days.

I am writing this letter to you in an effort to induce those who have a problem, admitted or unadmitted, to seek help. In my work, particularly among older people, I have seen miraculous personality transformations when a person hears once more. As you mention, it is sometimes difficult to come back to a noisy world from a comfortable silent shell.

Could I suggest that you publish a list of the many excellent organisations who have facilities, many free of charge to help those with hearing loss? Some come to local clinics and local halls, schools etc. if requested. They teach you how to listen, an accomplishment many of us lack, but also cover every aspect of hearing and referral for assistance.

I have not seen any reference to tinnitus (head noises) in your articles. It amazed me how many people, particularly those with hearing loss, have it. In my case I have a singing noise, very loud at times, around 5kHz. The hearing aid helps me by raising the outside sounds above the level of the noise.

Best wishes to the publication,

H.C. (Footscray, Vic.)

Appended to H.C.'s letter is an audiology test chart which he had taken recently. Without pretending to any expertise in this matter, it would seem to me that H.C. is a good candidate for a hearing aid. His loss of mid frequency is serious but not profound and, considering his age, he seems to have retained a surprising amount of response around 8kHz. What's more, his two ears are quite well balanced, which is the right situation for a stereo aid.

While people with 80-100dB loss would face a much greater problem, the chances are that there are plenty of others who could share H.C.'s experience. Particularly should this be so with hearing aids using true AGC, as distinct from the rather distortion-prone peak limiting systems.

H.C. refers to "the many excellent organisations who have facilities, many free of charge, to help those with hearing loss". We do not have a list of such organisations on hand but, if anyone does, we would be happy to consider it for publication.

H|H electronic

What P.A. Amplifier sells itself? —The H.H. MA100

A compact and portable powerful mixer amplifier which has achieved outstanding success in Europe, it features: Five separate controllable channels. — Individual Bass, Treble Volume and push button Reverb on each channel. — 10 inputs (i.e. two per channel) available. — Master Volume, Master Presence and Master Reverb control the final mix to the integral 100 watt power amplifier. — Superb crystal clear sound for the vocalist.
Additional features include Auxiliary Input for connecting two MA. 100's together giving ten channels (i.e. twenty inputs), Echo send and return and Slave output connections.

MA100: 10 inputs - 5 channels - 100 watts
Volume, Bass, Treble & switchable reverb
on each channel.

- PROFESSIONAL POWER AMPLIFIERS
- P.A. SYSTEMS
- INSTRUMENT AMPLIFIERS
- ECHO AND EFFECTS UNITS
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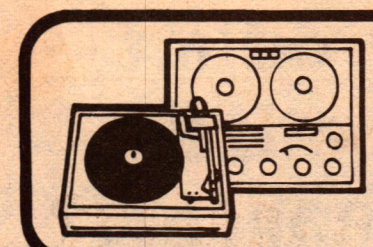


Hi Fi News

20,000 MASTERS: PORTRAIT OF A DISC RECORDING ENGINEER

Early in 1978, Frank Hulbert — Mastering Engineer at Astor Records, Clayton, Victoria, Australia — cut his 20,000th disc. This achievement is one which may startle many "experienced" experts in the cutting business, and boggle the mind of the novice.

by BILL HAWTIN*

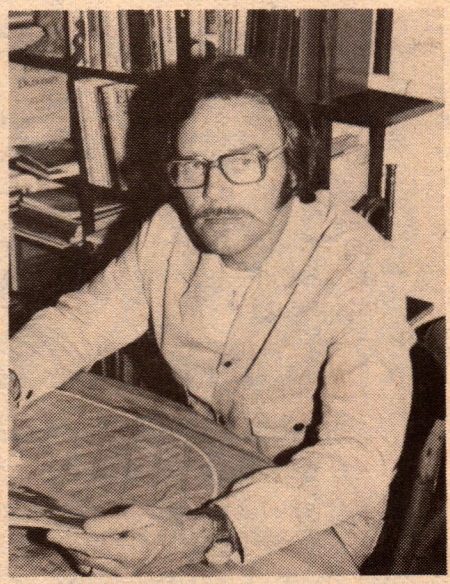
Frank's experience and expertise has earned him the respect of the recording industry in Australia, and has also surprised visitors from many of the foreign companies represented in Australia by Astor.

With such a background, what Frank has to say is well worth noting, as are his three principal "gripes":

- The mastering engineer has to salvage studio disasters all too frequently — and without credit for his effort in so doing.
- Too many Australian artists and promoters are ignorant of the expertise and equipment available in their own country. They prefer to "worship" anything done overseas, without even taking the trouble to see what can be done in Australia.
- Despite the fact that the record industry depends heavily on the work of engineers, their work is given small recognition. They tend to be regarded as part of the equipment.

Predictably, perhaps, Frank's pet hate is the person who knocks the local product as "the thing to do" and finds merit only in imports. Fair comment is one thing; "fashionable" bias is quite another!

*Bill Hawtin is President of the Audio Engineering Society (Melbourne Chapter). Private address: 77 Canterbury Rd, Canterbury, Vic 3126.



Frank Hulbert: from do-it-yourself battler to the engineer responsible for the quality of recordings cut at the Melbourne plant of Astor Records.

Like many engineers in the audio business, Frank started the hard way — by doing it himself, without tuition. He sees, as a sad commentary on a sophisticated industry that, even in Australia today, there are few, if any, training courses oriented to audio engineering.

Frank was born in London, UK. His working class parents could not afford to have him trained as an instrument maker, his career preference. He was obliged to leave school at the age of 14, so that he could contribute to family income.

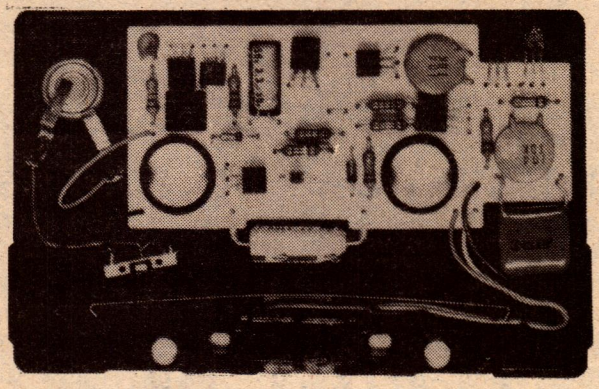
As it transpired, his first job was as a "tea-boy" at an electrical manufacturing company. His aptitude for electro/mechanical devices soon led to promotion to the position of lathe operator, and he spent about a year turning bushes for tuning capacitors and similar hardware.

An asthmatic condition, which has continued to plague Frank throughout life, was aggravated by the factory conditions. He moved, at the age of 15, to work in a live theatre as a stage hand and assistant property master. His most important show in this period was "The Maid Of The Mountains", staged at the London Coliseum theatre, and it gave him a feeling for the world of showbiz.

In 1943, he joined the army, and

Frank Hulbert (centre) sets up the microscope to inspect the grooves of a direct-cut disc which has just been completed at the Astor plant in Melbourne. Anxious to see how it turned out are members of the Steve Murphy Quartet, who had just made the recording. (See our August 1978 issue, page 27).

TDK's Revolutionary New Product — The HD-01 Head Demagnetizer Built into a Cassette Shell.

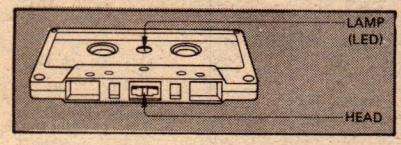


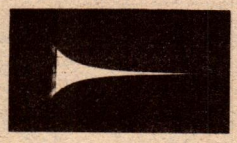
Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

The HD-01 Head Demagnetizer was designed by TDK for easy, convenient head demagnetization of any cassette deck, insuring crystal-clear, perfect recordings every time.

The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed. The above diagram depicts the oscillating waveform applied to the recorder heads, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.





The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.

The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

- recorders with heads positioned in the front of the unit but which point to the rear.
- those with 'pop up' loading mechanisms which can not be detached, thus making the heads almost inaccessible.
- cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
- automatic loading machines.

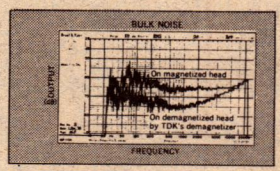
WHY IS DEMAGNETIZING SO IMPORTANT?

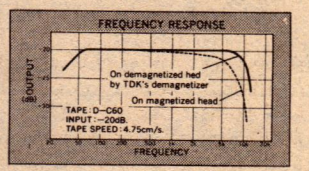
TDK, in conjunction with many cassette deck manufacturers, recommend that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.

The following comparison data clearly demonstrates the effect of residual magnetism on recorder heads in the areas of both Noise Level and Frequency Response.





TECHNICAL DATA

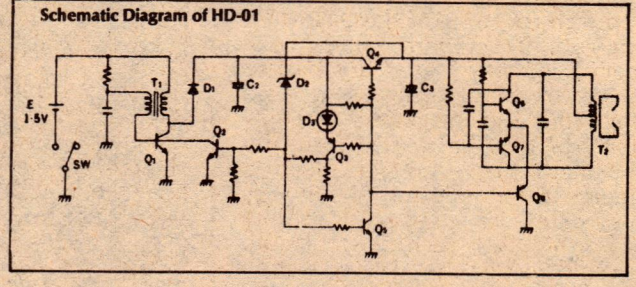
Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply – Control Section – Oscillation Section – Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

Schematic Diagram of HD-01



For additional information, direct all inquiries to:

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TDK®

served as a Bofors gunner in the forts in the Thames Estuary. (Some of these forts were used later in the sixties as sites for the contentious "pirate" radio stations.) As a gunner, Frank learned to operate radar equipment and gunnery predictors, and his involvement renewed his interest in electronics.

In 1946 he left the army, and took a position as a comptometer operator. He hated it. "Figures aren't my bag, I was too interested in music, and got into importing discs from the United States." The discs were jazz, early Stan Kenton 78's and the like, and he sold these throughout the UK by mail order.

Through his dealings with these records, Frank became interested in disc cutting, and in 1948 purchased some portable gear. He recalls that the first side he cut was a 78 dub of Woody Merman's "Apple Honey". "At the time, I thought it was terrific — strictly illegal of course. In retrospect, it was probably bloody awful!"

He started taking the recorder to jazz clubs, and with the aid of a single microphone, produced live recordings of doubtful quality.

The first group he recorded live was the Ronnie Scott Boptet, at the Club II. (In 1978 he cut his first Ronnie Scott disc as a professional engineer.)

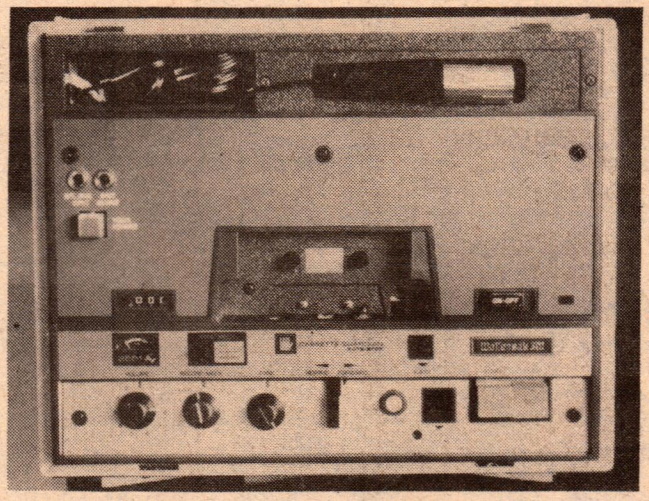
The acetates produced from the live sessions were sold to musos and jazz fans for 15 shillings each. This enterprise led to an association with a photographer. They pooled their talents, and sold records on their own "Discfoto" label, together with photographs of the artists.

Soon after leaving school, Frank had also started playing drums, and the jazz club atmosphere in which he now worked enabled him to expand this activity. In the fifties he played percussion with an outfit called the Burne Regal Quartet, with an electric accordion as the featured instrument. The band played for food and drinks at weddings and balls. He later became a professional musician and played in many London clubs.

The tape era opened for Frank with the purchase of an early model Ferrograph. By modern standards, it produced "ghastly" tapes but he had them cut on LP discs, and sold them through the jazz magazine "Melody Maker". In 1950 he helped form the Glen Miller Society, and takes pleasure in noting that the Society is still very active. Later he produced Johnny Dankworth's first recording session, which sold well on the "Tempo" label.

The London smog was aggravating Frank's asthma and, at the recommendation of relatives, he moved to Australia in 1955. In 1956 he joined Mercury Records in Melbourne. The record company was housed in a

"Wollensak" tape recorders, duplicators and teaching aids from 3M Aust.



Model 2551, a portable mono recorder with audio visual capability, including a public address facility.

3M Australia Pty Ltd has announced the release of a line of eight different "Wollensak" cassette recorders, cassette duplicators and language teaching aids.

Mr David Henderson, Product Manager for 3M Australia's MinCom Division, stresses that the units being introduced into Australia is the most recent generation of a range that the Company has been producing in the USA for over 20 years.

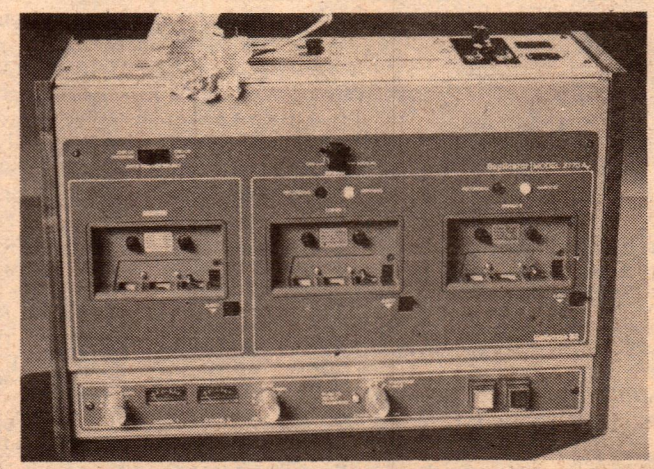
As a starting point, the model 2520ES is a heavy duty mono recorder with the emphasis on ruggedness and operational simplicity. It offers a response from 50 to 10,000Hz with a power output of 9W RMS into 8 ohms. Model 2551ES has similar basis specifications but includes facilities which enable it to be teamed with a slide projector for cued audio visual presentations.

Several models in the line are intended specifically for cassette duplication. The 2970AV is a portable high-speed duplicator which will produce a single copy at 13½ times original speed.

The 2770ES has facilities for producing two mono copies simultaneously and has auto-stop and alarm facilities to alert the operator in case any one of the cassettes should malfuction. The 2772ES goes one step further in being able to provide, not only two simultaneous copies of mono tapes but, as well, copies of stereo tapes. Up to three further copies can be produced with the aid of the 2780ES add-on duplicator.

For those interested in language lab facilities, the Wollensak 2526ES provides the heart of such a system, being intended to operate in conjunction with the 10ES Lab console. It can serve up to 10 students, each wearing headsets and each with access to the learning track.

For further details inquire at 3M offices in capital cities around Australia or direct to the Corporate Publicity Department, 3M of Australia Pty Ltd, PO Box 99 Pymble, NSW 2073. Tel (02) 498 0033 Ext 488.



The 2770 monophonic duplicator capable of producing two C-30 copies in just over one minute.

HIFI NEWS — Cont.

tin shed in the suburb of Richmond, and his first job was to listen to jazz records. "I'm getting paid for this?"

In those formative days the masters were dubbed on a Connoisseur lathe from imported pressings, often of poor quality. The overall quality of the subsequent copies was atrocious by today's standards. Later, the company purchased a Neumann lathe — one of the first in the country.

Frank became involved in inspection and "quality control", and when the company, now Astor Records, moved to the suburb of Huntingdale he helped design the matrix testing section. He then moved to tape editing and dubbing. In 1966 he was appointed to the position of mastering engineer, and the first side he cut in this role was a Tom Paxton single. He ruined this by inscribing the matrix number over the cut-out groove!

He has now been operating Neumann lathes for 12 years, and ironically, the 20,000th cut was a direct dub from an imported Greek pressing.

Anyone who has been in the audio business for very long always has a fund of anecdotes, and Frank is a goldmine of humour. His worst job was cutting 37½ minutes of re-issue Caruso tracks on one side of an LP.

The strangest task was to cut an album entitled "The Sounds of Silence" — two 12-inch sides of silent tracks of varying length — "to be played at any level without disturbing the neighbours.

But his pet story concerns another engineer who diligently cut a set of masters, marked them with matrix numbers and packed them for processing, without realising that he had failed to apply signal to the cutting head!

The shortest LP Frank has cut was Trini Lopez album which ran for the magnificent time of nine minutes per side!

Frank rates his involvement in the first direct-cut disc produced in Australia as his most exciting assignment. This was carried out for the Melbourne Jazznote label and, as the music was jazz, he was delighted.

His worst moment was the incidence of swarf problems during the direct-cut exercise.

Frank lives with his wife and family in the Melbourne suburb of Boronia, in the foothills of the Dandenong ranges. His hobbies are fixing things, and "my kind of music — jazz". Jazz has always been his first love, and in Australia he was involved for a period with an independent jazz label.

But, when he recently discovered himself tapping his feet to a steam train tape he was cutting, Frank decided that, maybe, he has been in the business too long!

REFURBISHING A BRAND IMAGE: PORTRAIT OF A HIFI EXECUTIVE

A recent visitor to Australia was Mr Herb Horowitz, Vice President of Teledyne Acoustic Research, of Boston Mass., USA. He was guest of honour at a function arranged by Acoustic Research Australia, who assembled, distribute and service AR loudpseakers in this country.

Primarily, Herb Horowitz' purpose was to emphasise the virtues of the current range of AR loudspeaker systems and, in particular, of their AR9, which was created with the design objective of being "the best loudspeaker in the World". While the AR9 is a story in its own right, Herb Horowitz also provided an interesting insight into the thinking and planning which brought to fruition the current very extensive AR range.

Many years ago, as a relatively young engineer, Herb Horowitz had founded the Empire Scientific Corporation, offering a range of prestige hifi products which were well known in Australia, with their characteristic burnished gold finish.

Subsequently, Herb Horowitz sold his interest in Empire to Harmon/Kardon, stayed with them for a while, and then decided to retire early in order to enjoy a life of leisure. But, after a few weeks of surf and sunshine, he became thoroughly bored and readily accepted an invitation to rejoin Harmon/Kardon with a specific task in view: to troubleshoot and revitalise the Tannoy operation, in which they owned a controlling interest.

With this assignment behind him, Herb Horowitz was approached by Dave Mulchler, President of Teledyne Acoustic Research, to do the same sort of thing for the AR loudspeaker line. He accepted the invitation and was named as Vice-President, in which role he visited Australia — apparently enjoying his "retirement" no end!

Years ago, AR had been number one for loudspeakers on the American market but, for reasons which were not immediately obvious, it had gradually slipped down the list. Firm action was needed to identify the problem areas and to reverse the trend.

Having accepted the assignment, Herb Horowitz' first step was to spend several weeks visiting hifi shops, examining their displays, listening to their sales spiels, seeking their reactions, and so on. One thing soon became obvious:

In most hifi stores, stereo loudspeaker systems were displayed with the grille removed from one of each pair to show the drivers. The AR units looked okay with the grille in position but, without it, the finish looked rough. It shouldn't have mattered, but it did — for a reason which also became apparent.

In a typical store, there would be a dozen or more systems on display at any one time but a given customer might listen to three or four of them, at the most. Which three or four depended on a variety of factors but, numbered prominently among them, was eye appeal without the grille. For Herb Horowitz the first job was obvious: Improve the finish of the baffle assembly so that it had a professional, quality look to at least match that of its competitors.

That way, the AR systems would stand a better chance of being selected for audition.

Next came a statistical survey on the market which showed that success or failure depended on what happened in about 400 key hifi outlets spread across the USA. Sell well in those outlets and you had it made; miss out and the rest didn't really count for much.

Ignoring those loudspeakers that were brand-tied to complete systems, the key hifi shops might typically concentrate on four brands, say: JBL, Advent, Bose and AR. The problem was to somehow get AR back to the dominant position. How could the range best slot into the market?

Among the loudspeakers mentioned, the JBL range tended to be up-market, the Advent down-market and the Bose somewhere in the middle, with its particular philosophy of dispersed sound. The AR range was nowhere in particular!

Ultimately, it dawned on Herb Horowitz that the self-classification of its rivals posed a problem for the salesman, from which he might relish an escape. Either he or the customer had to start somewhere in their con-

sideration of the systems on offer and, as often as not, discussion produced a shift up or down the price range. In the process, the salesman, having built a particular brand image, suddenly had to switch to another. Why not save him the embarrassment?

So the idea of a complete AR family was born, which would range from the least pretentious system that the company could regard as hifi, to something that might reasonably aspire to be the very best. The salesman could steart at any price level that seemed appropriate and sell up or down as necessary, without ever needing to switch brands.

But, for a family image, there had to be a family likeness and this was lacking in the AR range, which had been built up spasmodically over the years. The task was not just to expand the range by plugging in extra models, but to harmonise the appearance of the whole and to devise a way in which they could be displayed to advantage.

And here, a leading US advertising agency made certain important contributions. They confirmed that the AR image was blurred. "Acoustic Research" could be a name or a motto; or was AR the name, or A&R or what?

Apart from that, the product had a stuffy, conservative image, heavily orientated towards traditional classical music — and therefore to a minority market in terms of potential buyers.

As Herb Horowitz explained: It wasn't that anyone was unhappy with the sound of AR speakers; they generally agreed that it was fine. It was just that the vast majority of hifi buyers — who are younger people with a variety of musical tastes — did not identify with the product.

From all this, the new AR family emerged: with careful attention to the baffle finish, with a harmony in exterior design and a new, modern AR logo. And it spanned the whole range from a compact bookshelf (rated at 100 watts) to the ambitious (and expensive) 400-watt AR9. No less importantly, the various models had the same general balance in sound quality, so that there were no acoustic shocks in switching from one to the other — just the expected refinement that follows more and larger drivers and larger enclosures — all of the sealed variety, by the way.

And there was new look promotion, with an emphasis on modern rather than traditional classical music. Indeed, AR stress that their systems are as well suited as ever to the classical field; it's just that they want a much larger slice of the majority market involving younger buyers.

And, to judge from what Herb Horowitz has to say, they are getting it. The trend of a few years back has been reversed and AR is heading back towards the top in the vital markets.

Maybe AR should keep Herb where he is, until he really retires, just in case another manufacturer asks him to repeat the effort on their behalf!

PLESSEY COMMUNICATIONS SYSTEMS have added three new public address amplifiers to their product range. The UD-10 is an economy 10W model intended to meet a wide range of needs such as in office and industrial reception areas. It has a built-in electret microphone, a sloping panel with recessed controls and an ivory finish. Supplementary input facilities are provided for external microphone, tape recorder, record player, etc. Higher powered companion amplifiers are the UP-15 and UP-30, with multiple input facilities and power ratings of 15W and 20W respectively. Plessey Communications Systems are at 87 Racecourse Rd, North Melbourne 3051, and in other capital cities and Townsville.

New AM, FM tuners from Audiosound

Representing a welcome change from normal practice, two new radio tuners just announced by Audiosound provide the opportunity for better than normal quality from AM stations. The AM 101 is, in fact, an AM-only tuner offering variable selectivity, a 9 or 10kHz whistle filter, low distortion and coverage to 1750kHz. It uses manual rather than automatic gain control and has an easy-to-read tuning meter. The T 751 tuner also provides good AM reception but combines it with a high performance FM-stereo facility, featuring a special muting circuit and LED indicator for easy and accurate tuning. For further information: Audiosound Electronic Services, 148 Pitt Rd, North Curl Curl 2099. Tel. (02) 938 2068.

HIFI NEWS — Continued

A range of five new turntables under the brandname "Harksound" all feature low profile, European styling, with gun metal grey chassis, smoked acrylic lids and a black-finished straight tone-arm with offset head, rather than the more usual S-shaped, plated design. Harksound claim that the straight, unplated arms have acoustic advantages. The models HS 210 and HS 310 are belt drive semi-automatics; the HS 510 and HS 610 are direct drive designs with floating platter and tonearm assembly, while the top-of-the-line HS 910 has a quartz PLL speed control. The 210, 310 and 510 are fitted with Ortofon cartridges. For information: Harman Australian Pty Ltd, P.O. Box 6, Brookvale NSW 2100. Tel (02) 939 2922.

"SOUNDS VINTAGE" is the name of a new magazine which is to be produced on a bi-monthly basis, in England. Devoted primarily to the sounds of yesterday, it will cover vintage wireless equipment, gramophones and cylinder machines, vintage amplifiers and relevant pre-war literature. Articles will deal with the restoration and care of such equipment, stories of the pioneers, etc. Editor and Publisher will be Colin Riches, formerly Production and News Editor of "Practical Wireless". "Sounds Vintage" will comprise 32 A4 pages and will be available on subscription only, the rate being £6.80 for overseas subscribers. For further details: "Sounds Vintage", 28 Chestwood Close, Billericay, Essex, England.

BASF AUSTRALIA LTD, like the parent company, are still chafing at what they consider was an inspired "whispering" campaign to discredit chromium dioxide tapes on the grounds of head wear. Whatever might have been the merits or demerits of other companies' coatings, whether chrome or iron, BASF have been at pains to stress that their own chromium based coatings bear more than favourable comparison with their competitors' non-chromium counterparts.

Their latest batch of literature makes firm claims that their normal BASF Chromdioxid causes less headwear than popular chrome substitutes; that their Chromdioxide Super is better, in this respect, than either TDK SA or Maxell UDXL-II. This last statement, they would obviously have to be in a position to justify — or else! But, having made the point, they concede that the SA and UDXL tapes show excellent head wear characteristics anyway, leading to the conclusion that, in respect to the four tapes being compared, head wear is a non-issue.

ELMEASCO INSTRUMENTS PTY LTD, importers and manufacturers of electronic testing and measuring instruments for industry, research and communications, have been appointed Australian sales and service representatives for the Time Data, Acoustic and Electronic Instrument Divisions of Genrad Incorporated of Massachusetts USA. Genrad Inc., were formerly known as General Radio Company.

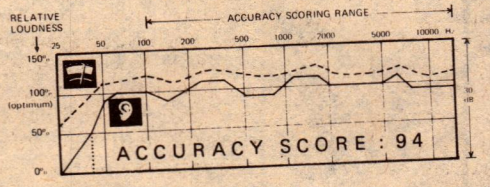
(Elmeasco will not be representing the Test Systems Divisions of Genrad.) Elmeasco Instruments, with sales offices in Sydney, Melbourne, Brisbane and Adelaide, are represented in Perth by Cairns Instruments Services.

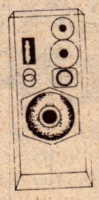
The Genrad 1977/78 catalogue is available by contacting any of the Elmeasco sales offices or direct to: Elmeasco Instruments Pty Ltd, 15 Macdonald St, Mortlake, NSW. Postal address: P.O. Box 30, Concord NSW 2137. Tel (02) 736 2888.

STOP PRESS

CONSUMER REPORT MAGAZINE RATE MARANTZ HIGHEST ACCURACY SCORE IN HIGH PRICED LOUDSPEAKERS!

FIRST marantz®





MARANTZ HD880
40¼ x 16 x 13¾ in. 62 lb. Bass half-loudness point: Very good (40 Hz). Freedom from bass distortion: Better than average. Power range required: 25-60 watts. Impedance: 4 ohms. Comments: Has very-high-frequency level control. Has removable bass-port plug to increase bass (see story). Had highest accuracy with tweeter control set at ¾ of maximum, other controls set at maximum, and bass-port plug in.

Competitive Speakers	Accuracy Rating
ESS AMT 1B	93
YAMAHA NS69011	92
AR 10 π	90
EPICURE 400	90
ALTEC MODEL 15	89
DAHLQUIST DQ10	89
JBL L166	89
PIONEER HPM 100	89
JENSEN 550	88
EV INTERFACE C	87
ADS 810	86
INFINITY QUANTUM 5	86
BOSE 901 SERIES 111	85
KLIPSCH HERESY HWO	83

The Report, which was prepared by the highly respected American organisation, Consumers Union, combined computer and laboratory measurements with expert listening tests to show that Marantz HD880 was the most accurate in a group of 14 highly regarded Hi Fi Loudspeakers.

"In CU's view, the most meaningful single standard for judging loudspeaker performance is accuracy - a speaker's ability to reproduce sound energy smoothly and uniformly over the entire musical spectrum. The higher a speaker's accuracy, or fidelity, the more fully it can respond to the entire spectrum of musical sound, from the tinkling of a triangle to the deepest tones of an organ."

But the sad truth is that most speaker manufacturers have given up on the accurate loudspeaker. Instead, they produce models with booming bass, sizzling highs and great vocal presence, and call it "personality". Trouble is, that "personality" doesn't come from the music at all, but from shortcomings in speaker design that actually distort sonic accuracy and create coloration.

Marantz chose instead, the more formidable task of working toward a loudspeaker which is as accurate as theoretically possible. When you combine accuracy with Marantz quality, YOU HAVE A WINNER.

FULL COPIES OF REPORT AVAILABLE ON REQUEST

Superscope (A/Asia) Pty. Ltd. 32 Cross St. Brookvale. N.S.W. 2100 Tele: 939 1900

Technics SA-400 stereo receiver

The Technics SA-400 is one of four new stereo receivers recently released on to the Australian market. The SA-400 is most powerful of the group, with a rated power output of 45 watts per channel for a bandwidth of 20Hz to 20kHz. The line is of particular interest because it represents a new engineering approach by Japanese manufacturers.

Compared with previous models, superficially there is not a great deal to indicate that a different approach has been taken with the new Technics SA-400. It has all the features normally found on a stereo receiver in the medium price range.

Overall dimensions of the Technics SA-400 are 430 x 142 x 300mm (W x H x D), including knobs and feet. Mass is 8.2kg. Those figures by themselves show the results of the new approach — the new receiver is appreciably smaller and lighter than some of its competitors.

Styling of the Technics receiver is low keyed, with brushed aluminium front panel and knobs to match. The control layout is well thought-out and easy to drive. There are two large knobs at the right-hand end of the panel; the upper knob is for tuning and is flywheel assisted. The knob below is the volume control and this is detented (40 detents in all).

We do not see the point of having 40 detents on the volume control, since it has neither logarithmic calibrations nor better than usual matching between sections. The Balance, Bass and Treble controls do not have detents.

Two push-buttons provide for selection of two pairs of loudspeaker systems. These buttons are neddlessly small, however and thus seem to require more than usual pressure. The buttons on the cheapest model in the line, the SA-100, are larger. Why?

High and low filters are included in the control line-up but, like filters on most amplifiers and receivers, they are inadequate in effect because of their modest slope of 6dB/octave.

A mono/stereo switch was one fature omitted which we find useful, albeit mainly when testing. It is handy to enable reproduction of a mono source through both channels.

Some receivers and tuners we have tested in the past have had too much dial illumination. The SA-400 is almost the opposite. In brightly lit rooms it is difficult to tell, by sight, whether or not it is on. At night or in dimly lit rooms, the dial illumination is just right. Perhaps the brilliance needs to be adjustable.

We also found the meters a little too deeply recessed for convenient use when tuning the receiver — unless the meters are almost at eye level.

On the rear panel, a noticeable change is the omission of the usual adjustable ferrite rod aerial for AM reception. Is this an admission by Technics that most users seldom have room behind their receivers to hinge out and correctly orientate the rod antenna, or is it just an economy measure? Whatever the answer, the rod is now relegated inside the receiver, to a fixed position above the tuning gang.

Another noticeable change concerns the loudspeaker connections. Previously, most amplifiers and receivers from Japan have had spring loaded terminals. On the SA-400, a different termination is used. The bared wires are pushed into a plastic fitting, which is then twisted to lock it.

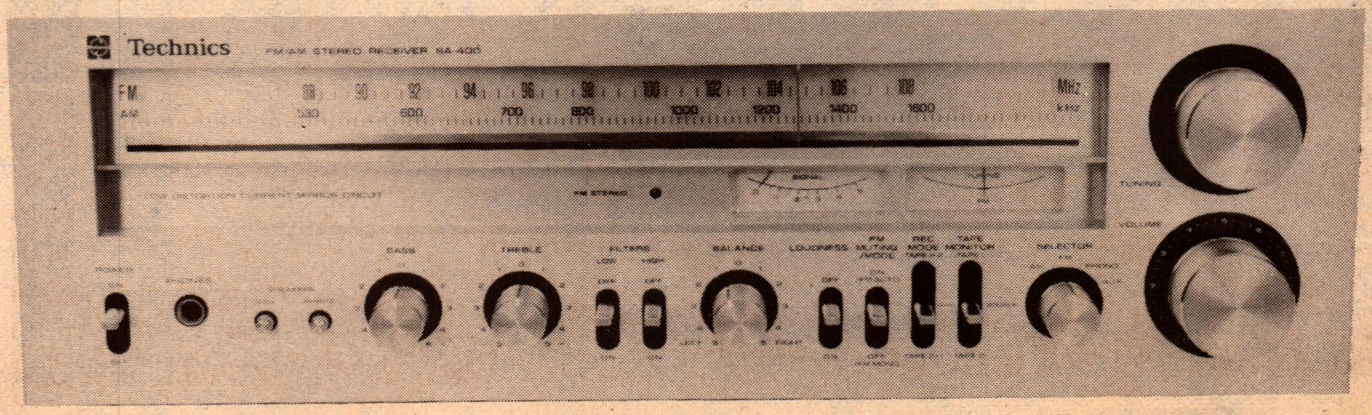
This is a desirable feature since it shrouds the loudspeaker connections, prevents accidental contact by the user and also prevents short-circuits. Shrouded loudspeaker connections of one sort of another will eventually be a mandatory feature on all amplifiers and receivers capable of producing more than 32 volts RMS, according to an IEC recommendation.

Besides meeting the local standards concerning mains power connection, the Australian version of the SA-400 is the first receiver we have seen with isolating capacitors in series with the FM and AM antenna connections. Thus the antenna circuitry appears to conform to the intent of Australian Standard AS 3159 (Electronic Sound & Vision Equipment).

This involves the use of suitably rated antenna input coupling capacitors, so that a catastrophic fault within the receiver does not raise the possibility of electric shock via the antenna cable or the antenna itself.

Removing the timber cover reveals the major differences between this receiver and those produced up to now. For quite some time this reviewer has felt that typical receivers and amplifiers from Japan (and elsewhere, for that matter) have been far too complicated in their mechanical assemblies. There have been very complex chassis, expensively tooled front panels, multitudinous PCB assemblies and nightmarish wiring.

This has meant, quite frankly, that the larger receivers have been nightmares to service. Fortunately, most of this equipment has been very reliable.



Now, however, the Japanese designers seem to be taking a simpler approach, as evidenced by the SA-400.

Two large PC boards accommodate all of the circuitry. All the input and output connections and all the switches and controls are soldered directly to these boards. This means that apart from the mains wiring to the power transformer, there is very little "wiring" at all. Access to the underside of the two PCBs is gained by removing the hardboard base panel of the receiver.

So for the first time, we have a receiver of this power rating and circuit complexity with excellent accessibility to all parts of the circuit. This makes service easier, but the fact that there is such a great reduction in individually soldered or wire-wrapped joints must also increase the reliability of the design.

Most of the circuitry uses ICs. This is most apparent in the tuner section, where the limiter/detector, multiplex decoder and AM circuitry are all ICs with little in the way of ancillary discrete semiconductors. The phono preamplifiers are also integrated circuits using seven-lead in-line packages.

The power amplifiers have a number of interesting features. First, there are no power transistors as such, with their individual sockets and connections thereto. Instead, there are two "Darlington power packs", one for each channel, bolted to the large heatsink assembly and each connected to the PCB by nine pins. Each of these packages contains not only the Darlington power stages of a conventional complementary output stage, but also the quiescent current stabilising circuit.

The early stages of the power amplifiers incorporate a "current mirror" circuit which is alluded to on the dial of the receiver. The "current mirror" is actually borrowed from integrated circuit technology and is used here to improve the symmetry of the differential input stage. It takes the form of a single transistor and diode arranged as a modified current source load for the output collector of the differential input pair.

Technics have not made a great deal of this feature and readers would be correct in concluding that it is another minor circuit variation. Yes, it evidently does work but other circuit variations might have been included which could have produced an equivalent result.

As in most receivers in this class, the SA-400 incorporates comprehensive protection circuitry which also eliminates switch-on and switch-off thumps.

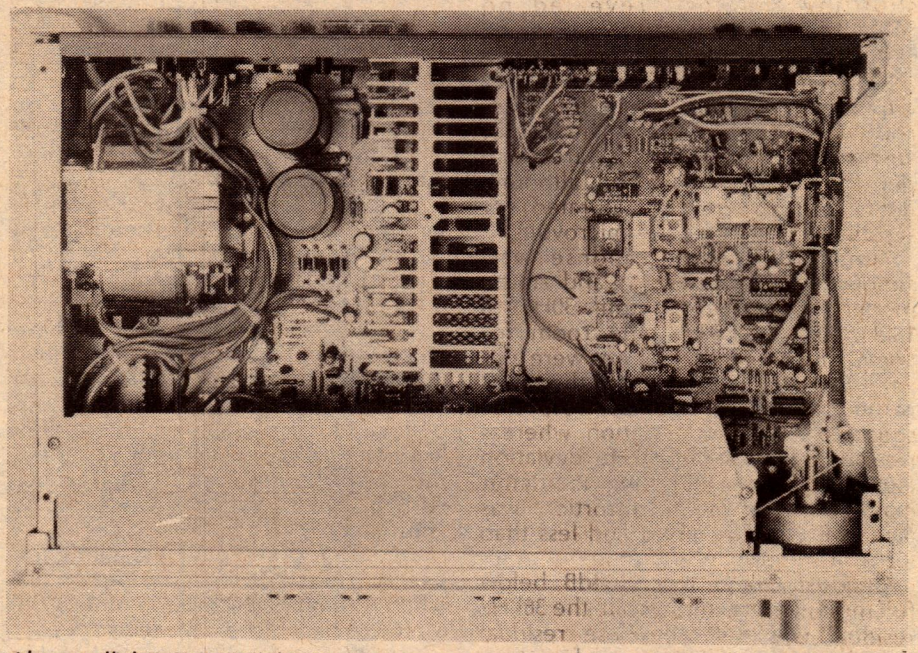
Performance testing reveals that while the SA-400 might be lighter and more compact than its direct competitors, the results are directly comparable. Power output is rated at 45 watts per channel into 8-ohm loads, with both channels driven, for a rated distortion of 0.04 per cent or less over the bandwidth of 20Hz to 20kHz.

At a test frequency of 1kHz, we measured 50 watts per channel with both driven into 8-ohm loads, at the onset of clipping. With one channel driven, the figure rose to 57 watts. With 4-ohm loads the power was almost the same, at 56 watts per channel with both driven or 66 watts into one channel. With 16-ohm loads, the power output is 33 watts per channel with both driven and 36 watts with one channel.

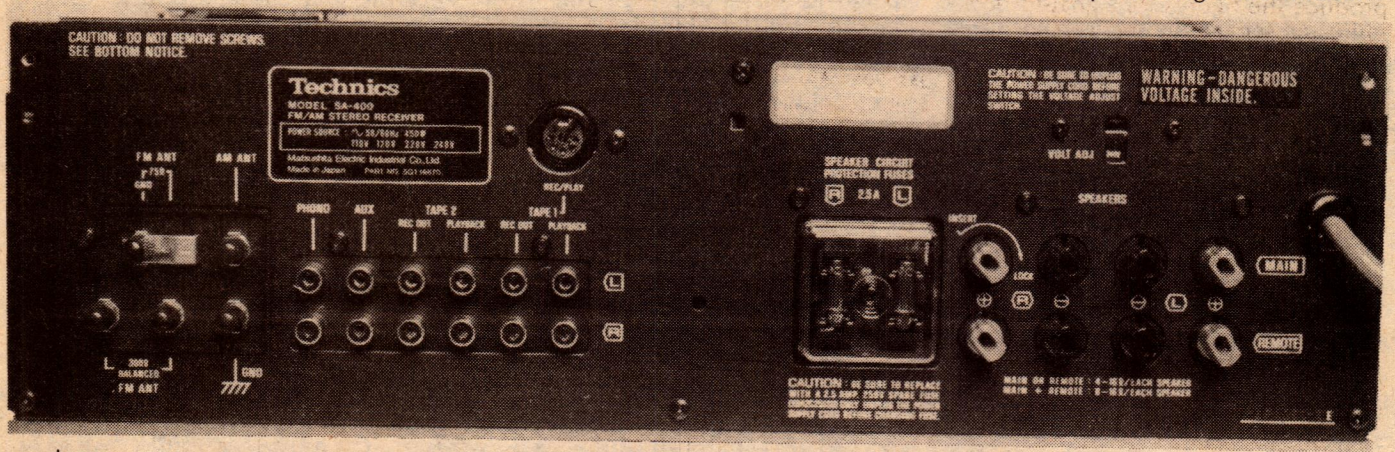
At 20kHz, the harmonic distortion was above the rated figure of 0.04% but at powers of 20 watts and below it was 0.1% or less, which is still very good. Intermodulation figures were not quite as good as rated, but also quite creditable.

Frequency response at one watt into 8 ohms is 1dB down at 10Hz and 40kHz. RIAA equalisation is rated at ±0.2dB over the range 30Hz to 15kHz, but we measured the limits as ±1dB, which is more to be expected considering the tolerances of components in the equalisation networks. Still this is quite OK.

Phono sensitivity for 10 watts was 1.25mV at 1kHz. Signal to noise ratio



Almost all the wiring of the SA-400 is on two large PCBs, producing a neat interior.



with respect to 10 watts and 10mV input was 66.5dB unweighted with a typical cartridge connected. These figures are about average. As with most receivers with conventional laminated core transofrmers, the noise figure can only be obtained if the turntable is 60cm, or more, away from the unit. Phono input overload is more than adequate at 250mV at 1kHz.

Using the auxiliary inputs the signal-to-noise ratio is 76dB with respect to 10 watts, while separation between channels was 53dB at 10kHz and 54.5dB at 1kHz and 100Hz. Sensitivity for the 10W reference power was 73 millivolts RMS.

Stability testing with capacitances shunting the load revealed no problems in this regard.

Reference to the tuner quieting performance graphs shows that they are marginally better than for other receivers in the class. The meter response characteristics are also perhaps a little more useful, although the meter is virtually saturated for signals of more than 500 microvolts.

Tuner frequency response was, almost identical in mono and stereo modes, within ±2dB from 30Hz to 15kHz which leaves little room for complaint. Separation figures were also very good, particularly in the mid-range. Harmonic distortion was specified for 40kHz deviation, whereas we normally test at 75kHz deviation (100% modulation). Using the latter conditions, harmonic distortion was less than 0.2% in mono and less than 0.3% in stereo.

Residual 19kHz was —34dB below full modulation output while the 38kHz residual was —49dB. These residual signals have to be filtered out to produce the figures for signal-to-noise ratio, and separation between channels and harmonic distortion.

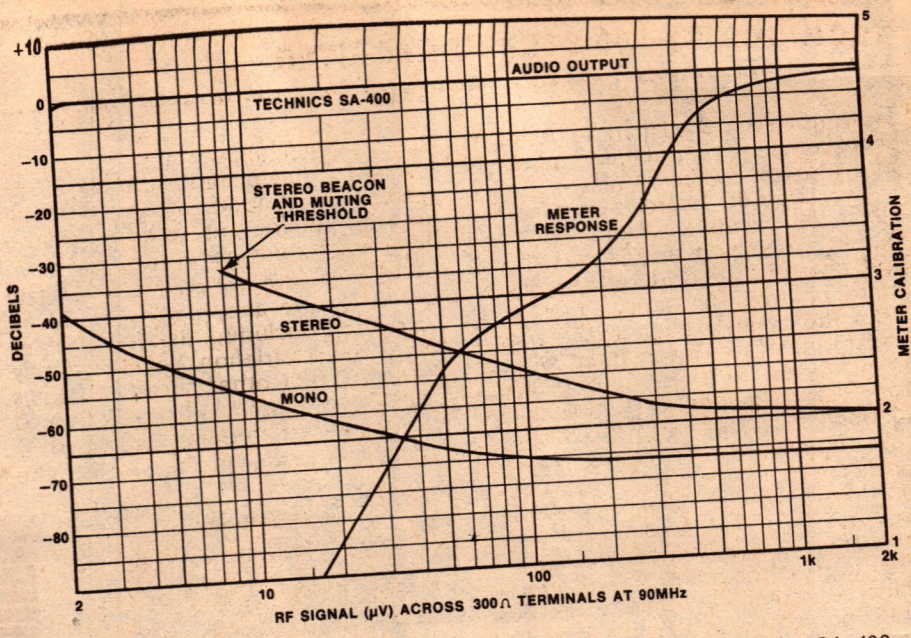
Once again, the AM tuner in the SA-400 is just about as poor as any in typical Japanese stereo receivers — at least its narrow bandwidth will mean few problems with 9kHz heterodyne whistles.

Accessories provided with the SA-400 comprise a simple dipole antenna for FM reception and a packet of fuses for the loudspeaker protection block on the rear panel.

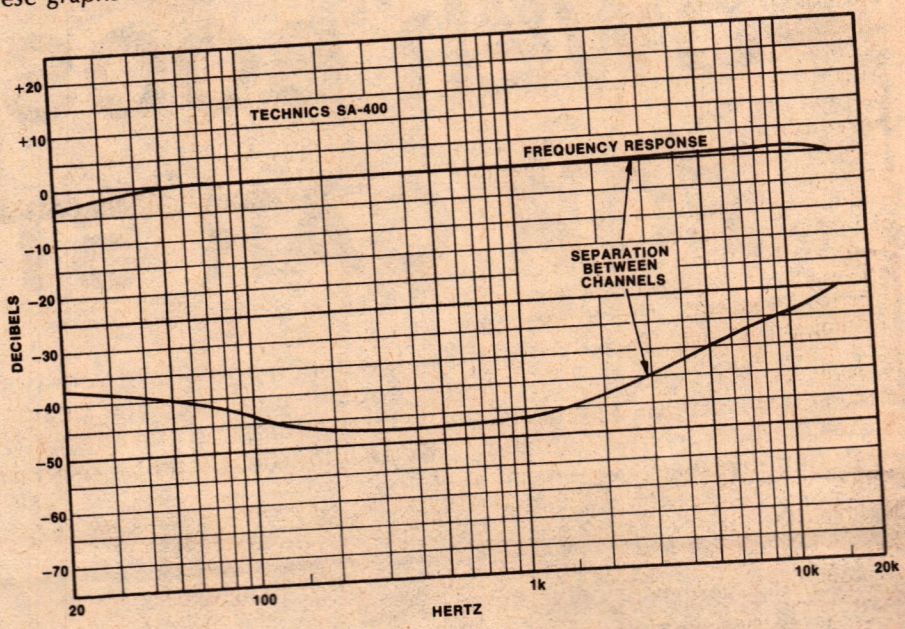
A comprehensive manual is included with the SA-400, and a full circuit diagram is supplied. Warranty is for 12 months from date of purchase.

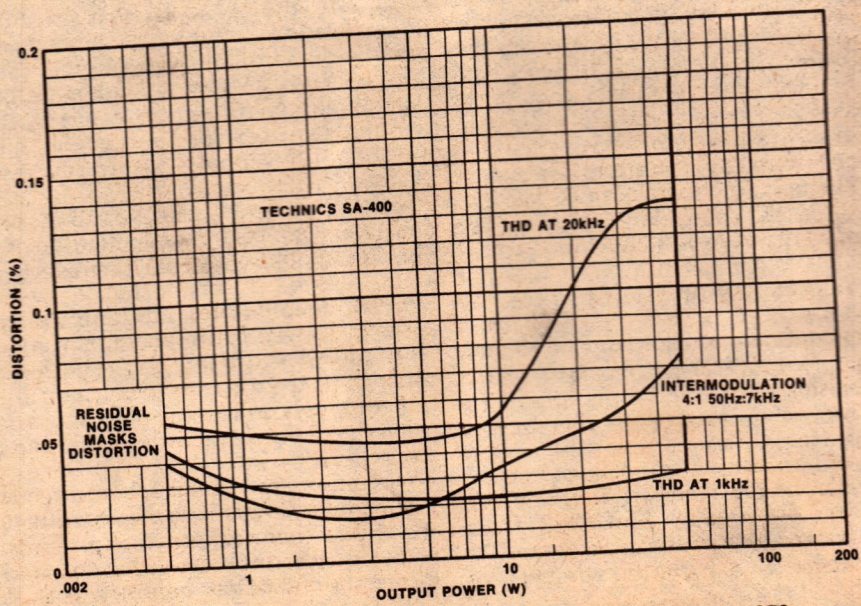
Our overall impressions of the Technics SA-400 are favourable. It is well-designed both electrically and mechanically and should give many years of trouble-free performance. Recommended retail price of the SA-400 is $489.00 including sales tax.

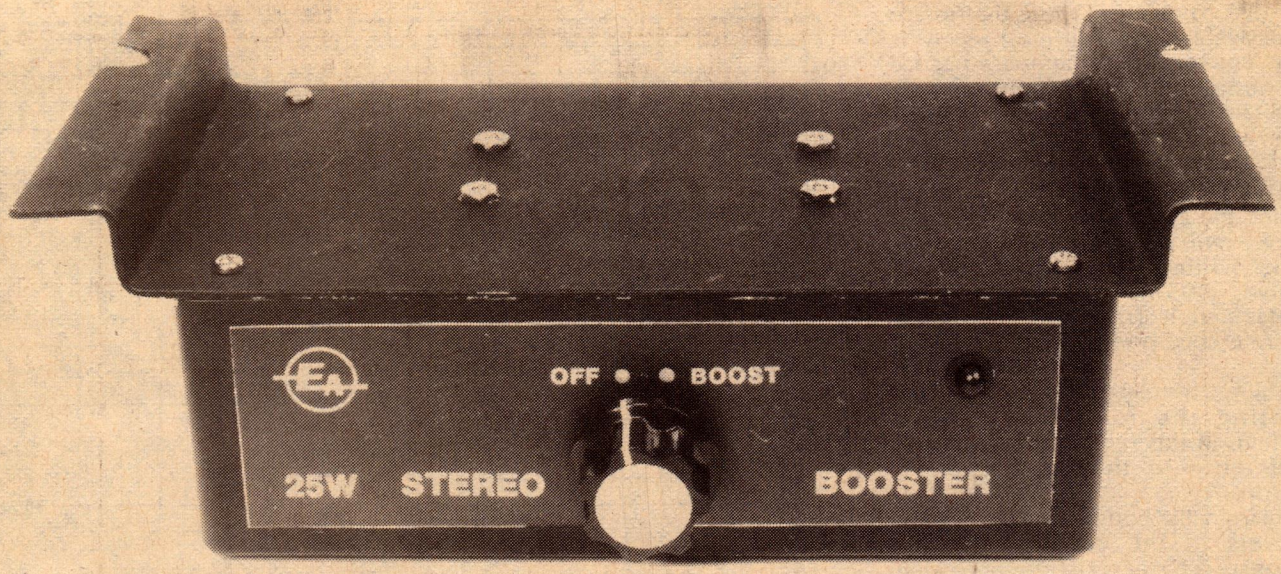
Further information on Technics equipment can be obtained from high fidelity retailers or from the Australian distributors, National Panasonic (Australia) Pty Ltd, 57-59 Anzac Parade,Kensington, NSW 0233. (L.D.S.)



These graphs summarise most of the performance parameters of the SA-400.







POWER BOOSTER FOR CAR STEREOS

Does your car stereo system lack the punch and bite of your home hi-fi? If so, build and fit this new booster amplifier. The design is based on a rugged single IC amplifier module, and can supply 12W per channel from a nominal 13.8V DC source. It can be used with all negative earth electrical systems.

by DAVID EDWARDS

Car stereo systems based on either FM radio or cassette signal sources have become quite popular of late, but they tend to suffer in power capability compared with the more usual domestic hi-fi. A power booster is the obvious solution to this problem, and can be quite an economical addition to the system.

The unit described in this article is intended for connection in the speaker lines between an existing stereo amplifier (such as is normally included in a stereo cassette player or stereo FM radio) and a pair of 4 ohm speakers.

Operation of the unit is controlled by the OFF/BOOST switch, and a LED is provided as a reminder that the unit is turned on. Internal preset volume controls are provided, so that the gain of the booster can be adjusted. Under normal circumstances, the volume of the boosted sound is controlled by the volume control of the signal source.

Our design is based on a new audio power IC, the TA7241P. This is a Toshiba device, and is mounted in a metal and plastic dual-in-line style package. Each IC contains two independent audio amplifiers, featuring self-centring DC output bias, overload protection, and with a high peak output current capability.

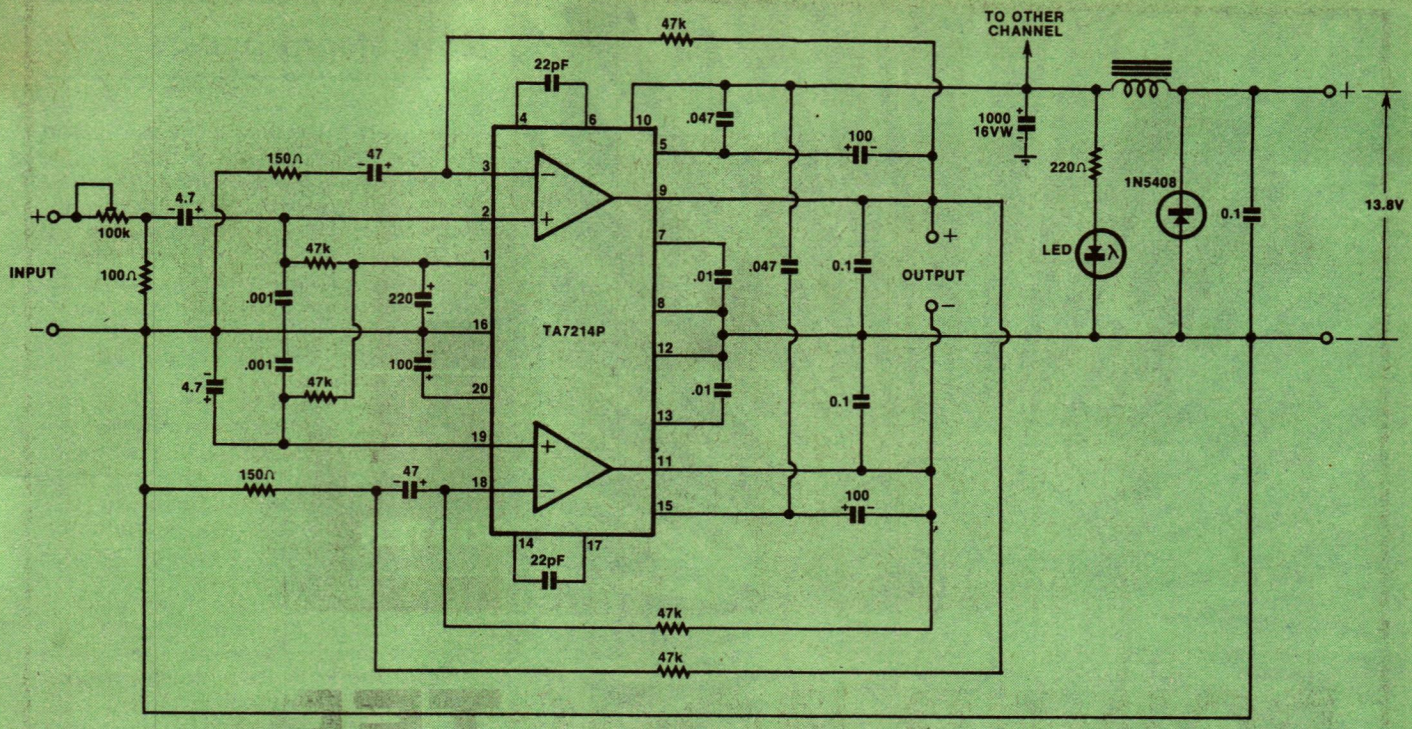
We have used two ICs, one per channel, with each one configured as a bridge amplifier. The load (in this case a loudspeaker), is connected between the two amplifier outputs, and the inputs are driven in antiphase. Since the two amplifiers are integrated onto the one chip, the DC offset between the two output is quite small, thus avoiding the need for an output coupling capacitor.

The advantage of this scheme is that the effective peak-to-peak voltage across the loudspeaker is now nominally twice the DC input voltage, and hence the nominal output power is four times that of a single class B amplifier. Of course, the actual output power is somewhat less than this, due to the inherent losses in the output stages.

In practice, with a 13.8V DC input voltage, we obtained an output power into a 4 ohm resistive load of 12W. At an output power of 10W, the distortion is typically less than 1%, while at a 1W output, distortion is typically less than 0.1%.

The distortion is primarily cross-over distortion, with a small element of 2nd harmonic distortion caused by a slight gain mismatch between the two halves of the bridge. The frequency response extends from 50Hz to 100kHz, measured at the —3dB points.

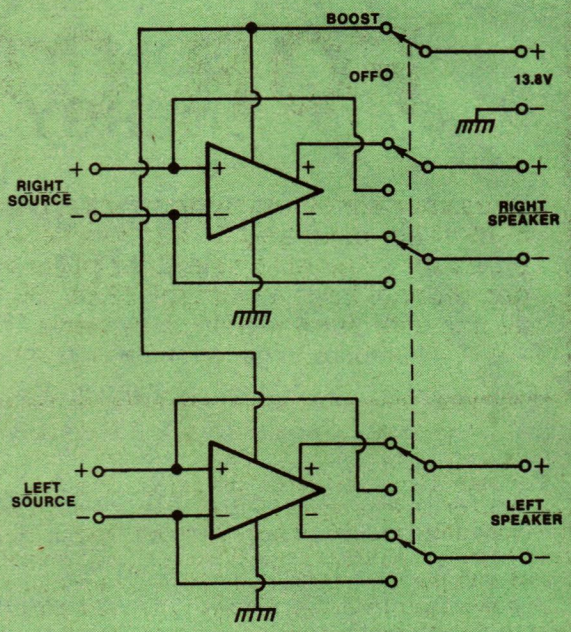
Signal-to-noise ratio (with respect to 10W into 4 ohms), is —78dB, while separation between the two stereo channels is better than —51dB. Maximum sensitivity is 26mV, and the quies-



EA 25W STEREO BOOSTER
(ONE CHANNEL ONLY)

1/SA/–

The circuit diagram above is for one channel of the amplifier only, and shows only the circuitry contained on the printed board.



The schematic diagram on the right shows how the amplifiers are connected to the source stereo by the OFF/BOOST switch.

cent current drain is only 70mA. Current drain at full power is 3 amps.

The unit is only suitable for use with cars having the negative side of the battery connected to the chassis, and requires the speakers to be fully isolated from the chassis. The negative input leads of the booster are connected to the chassis.

As you can see from the photographs the unit is mounted in a plastic Zippy box, with the aluminium lid replaced by a more substantial aluminium heatsink which also doubles as a mounting bracket. The unit is intended to mount on the underside of the dashboard.

All of the circuitry is contained on a single printed circuit board, coded 78sb12 and measuring 122 x 80mm. The power ICs are mounted on the copper side of the board, so that they can be clamped directly to the heatsink. The machine screws used to do this also form the board mounts.

The interconnections to and from the unit are made with hookup wire, passing through grommetted holes in the rear of the case. An inline fuse is provided in the positive supply line. This provides protection against excessive currents, and also against supply reversals.

This latter facility depends on the reverse connected diode installed across the supply line at the PCB. If the supply polarity is reversed, the surge of current passing through this diode blows the fuse, preventing damage to both the diode and the remainder of the circuit.

The only control for the booster is a two position rotary switch. This serves as both a power switch and as a speaker switch. In the off position, the booster is unenergised, and the outputs from the signal source are connected directly through to the speakers.

In the on or "boost" position, the booster amplifier is energised, and the outputs from the signal source are connected to its inputs. The booster outputs are now connected to the speaker leads.

All of the parts for the booster should be readily available. The TA7214P ICs and the power choke are imported by Dick Smith Electronics, and should be available through the usual sources. The heatsink is fabricated from 1.2mm (18SWG) aluminium. A dimensioned drawing is included elsewhere in this article.

The front panel of the prototype was made from self-adhesive photosensitive aluminium. A full sized reproduction of the artwork used is included with this article. In due course, commercial panels should become available from the usual sources.

Construction of the unit should be relatively easy, even for inexperienced constructors. Commence by fitting all the hardware to the case, including the LED indicator and the grommets. Check that the PCB mounting holes

align with those in the heatsink, and that the holes are free of burrs.

Now fit all the components to the PCB, apart from the ICs. Check carefully that all the electrolytic capacitors are orientated correctly, and that all joints are soldered correctly. Pay particular attention to the soldering of the mounting lugs of the choke, as these form part of the circuit. Set the volume presets to their mid points.

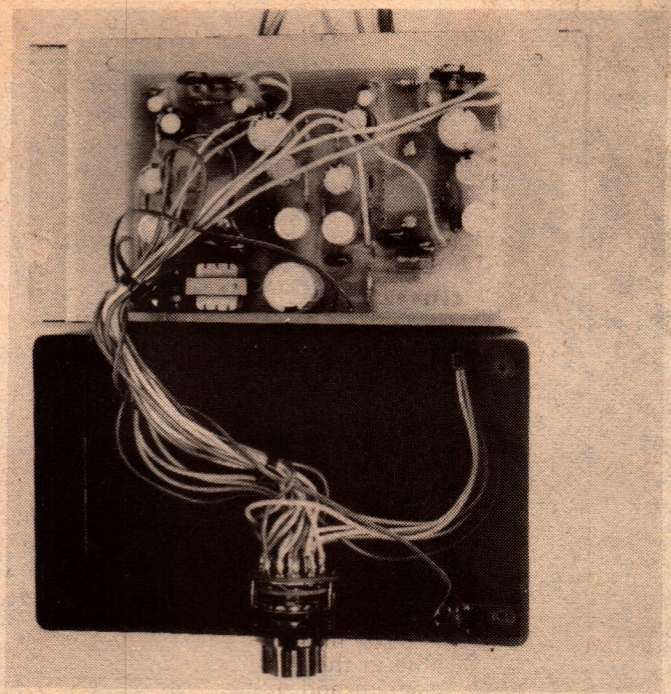
We recommend the use of PCB pins for all external connections to the board, as these make the final wiring of the board much easier. The final stage of the PCB assembly is to fit the ICs. These mount on the copper side of the board, and must be orientated correctly.

There is a small identifying mark at one end of the IC, signifying pin 1. This must be matched with the appropriate hole in the PCB. Refer to the overlay diagram, and also the PCB pattern itself, which has pin 1 marked.

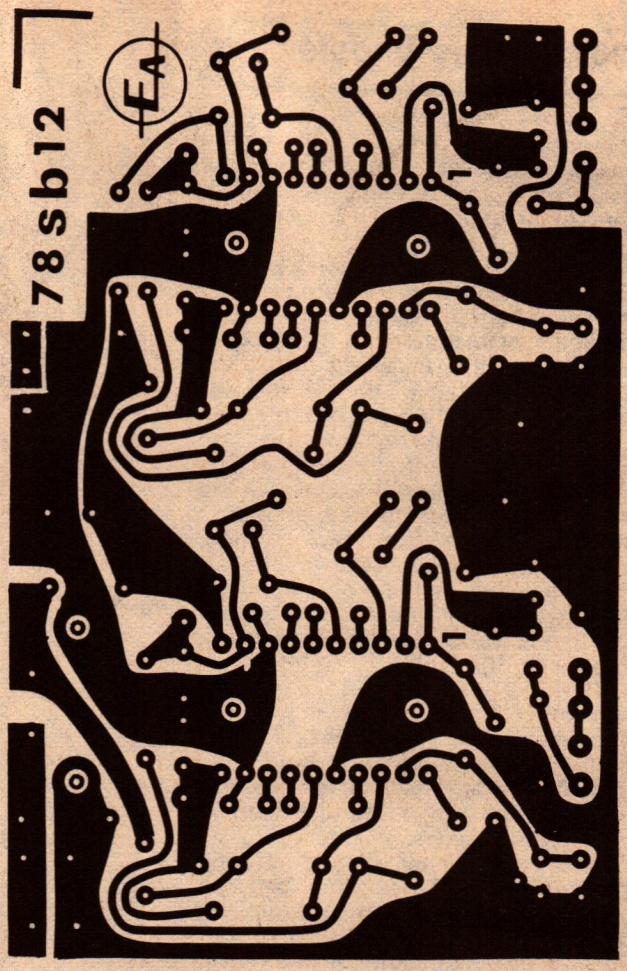
PARTS LIST

2 TA7214P audio power ICs
1 3A silicon diode, 1N5408 or similar
1 power choke (see text)
1 red or green LEd and mounting clip
1 aluminium heatsink (see text)
1 Zippy box, 150 x 90 x 50mm
1 2 position 6 pole rotary switch and knob to suit
1 printed circuit board, 78sb 12, 122 x 80mm
1 front panel (see text)
2 rubber grommets
4 machine screws and nuts
1 5A fuse and inline holder
Solder, hookup wire, cable clamps, tinned copper wire
RESISTORS (all ¼W)
2 100 ohm, 4 150 ohm, 1 220 ohm, 10 47k
2 100k 5mm lead spacing trimpots
CAPACITORS
1 1000uF 16VW radial lead electrolytic
2 220uF 16VW radial lead electrolytics
6 100uF 16VW radial lead electrolytics
4 47uF 16VW radial lead electrolytics
4 4.7uF 16VW radial lead electrolytics
4 0.1uF polyester
4 0.047uF polyester
4 0.01uF polyester
4 0.001uF polyester
4 22pF ceramic

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



The photo above shows how the PCB and heatsink assembly is wired into the case. The PCB pattern is reproduced actual size at the right.



Use a minimum of solder for the joints to the PCB, and check carefully when you have soldered all 20 pins that there are no solder bridges. Any such bridges are best removed with the aid of some desoldering braid.

Now mount the PCB assembly to the heatsink, using a small amount of thermal grease to improve the heat transfer characteristics. All that remains now is to complete the internal wiring between the switch and the board.

Use the wiring diagram as a guide, and complete the wiring with multi-coloured hookup wire. We found it advantageous to code the individual wires using paper labels, as not enough colours were available to individually distinguish each wire.

Once the unit is completed, all that remains is to fit and wire it to the car. Start by determining the mounting location, which should be under the dashboard in some convenient place. Try to mount the unit away from either the driver's or the passenger's knees.

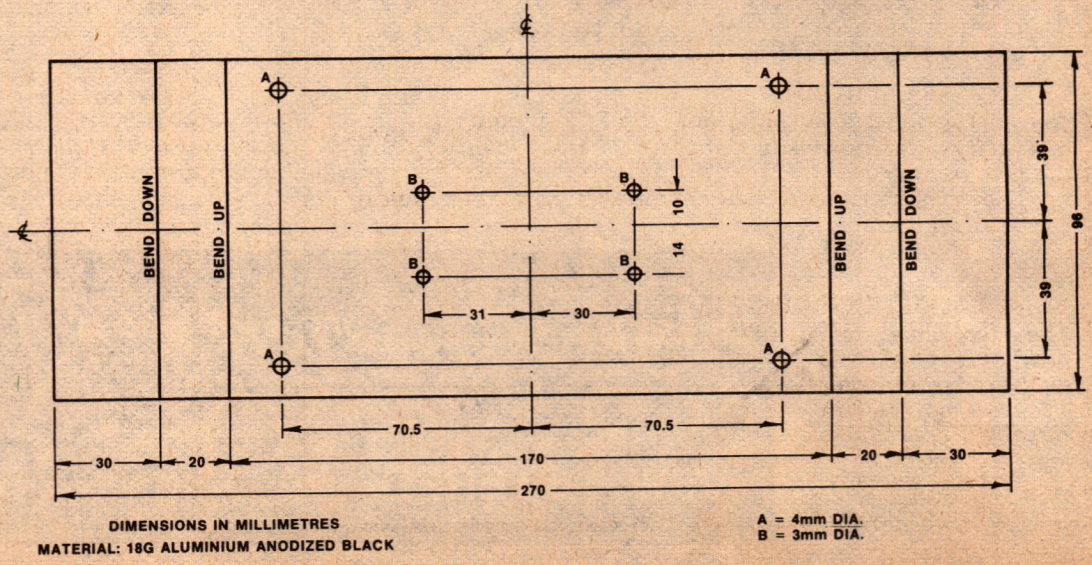
There may be existing screws in the dashboard which can be utilized, or it may be necessary to use additional self-tapping screws. In either case, mark and drill the heatsink first.

Now locate and identify the power wires to the signal source unit. One of these wires will be connected to the car chassis, and this wire must be connected to the negative supply line of the booster. The positive supply line of the booster must connect to the positive supply line of the source unit.

These connections can be made with either the new Scotchlok connectors, or by soldering. In the latter case, the joints must be well insulated. (Scotchlok connectors involve no stripping, soldering and insulating, and are available from auto electricians and also from DSE — cat. no. H-6720).

Now locate the wiring to the left speaker. There should be two wires. Cut these, and join the speaker ends to

Use this drawing of the heatsink as a guide if you are constructing your own heatsink. The outside of the heatsink can be painted black to improve it's thermal efficiency.



DIMENSIONS IN MILLIMETRES
MATERIAL: 18G ALUMINIUM ANODIZED BLACK

A = 4mm DIA.
B = 3mm DIA.

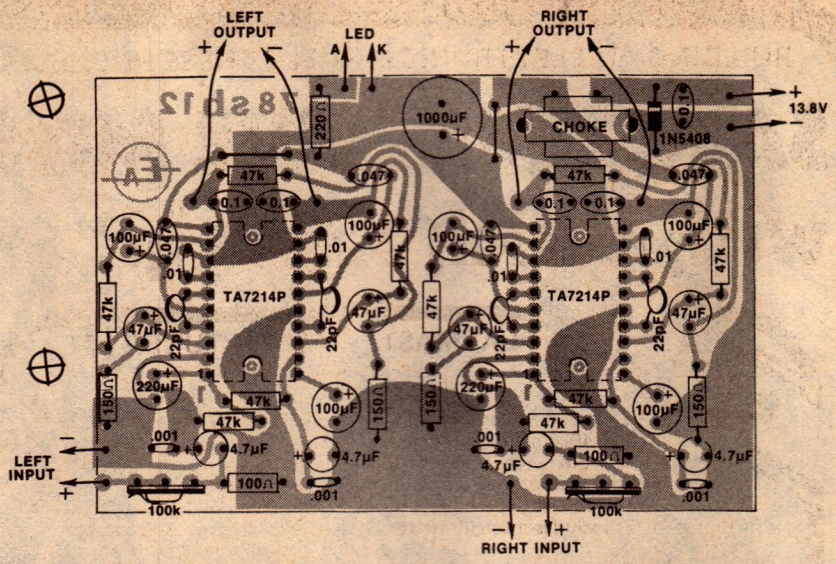
the left booster output. Check before you do, however, that both wires are insulated from the vehicle chassis. If they are not, you will have to rewire the speaker so that they are.

Now locate the wire leading back to the source unit which is connected to the vehicle chassis. Connect this wire to the left negative input of the booster, and connect the remaining wire to the left positive input of the booster. Insulate all connections thoroughly.

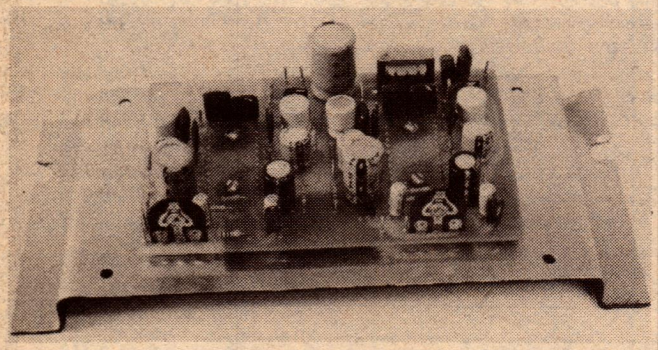
The right speaker connections are treated in an identical manner to the left speaker connections. Once all the wiring has been completed, go over it and double check for mistakes. Then, leaving the booster switch in the off position, switch on the program source, and check that it operates correctly. At any sign of trouble, switch off and trace and rectify the fault.

With the program source volume control set at minimum, switch on the booster. There will probably be a thump from the speakers, and then silence. Now advance the volume control, and check that sound is coming from both speakers.

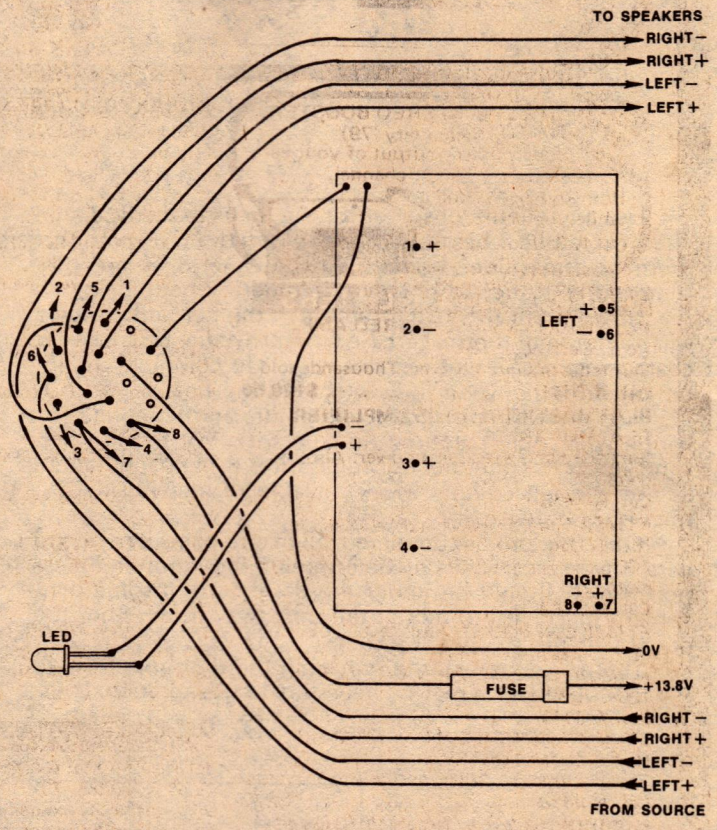
Switch the booster off, and note the change in sound intensity. With the booster on, the sound should be significantly louder. If it is not, adjust the two presets to suit. Do not adjust for too great an increase in intensity, as this will only make the operation of the source volume control rather fierce. It will not increase the available power level.



Use the overlay diagram above as a guide when assembling the components onto the PCB. Note that the power ICs are mounted on the copper side of the board.

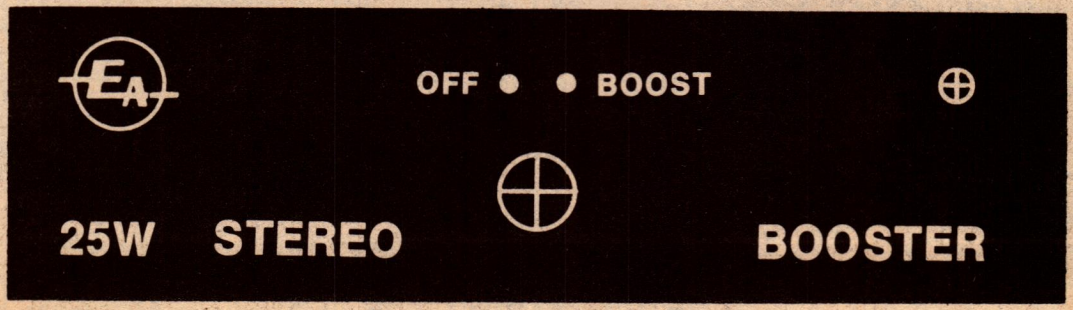


The photograph above shows how the PCB assembly is mounted on the heatsink. Use thermal grease to improve the heat transfer rate.



Shown above is the wiring diagram. Connections to the stereo source and the speaker wiring are made with connectors as described in the text.

The front panel artwork is reproduced at the right. It is actual size, and may be used directly if desired.



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(See page 46 November 1978 E.A. and page 42 December 1978 E.A.)

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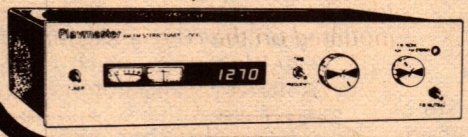

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DICK SMITH ELECTRONICS

"Universal" Tacho uses HT pickup

Here is a low cost portable electronic tachometer designed to work with almost any kind of ignition system — conventional, transistor-assisted, CDI, breakerless, magneto or what-have-you. It uses a standard tachometer IC, but feeds it from a special shielded capacitive HT pickup.

by J. de C. GRANDIN A.S.E. (Aust.)

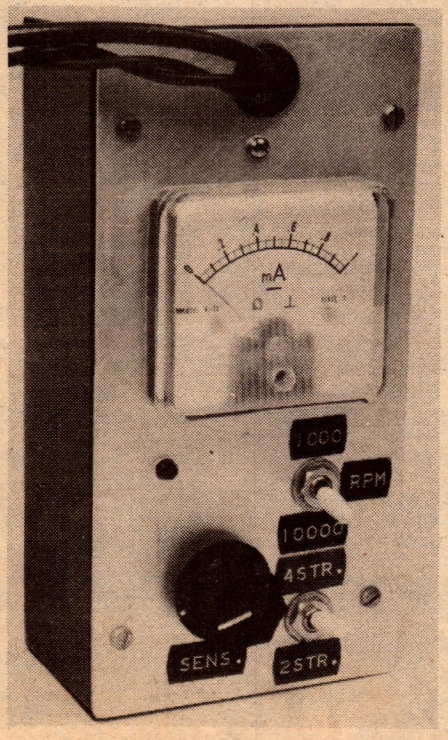
155 The Boulevarde, Strathfield 2135.

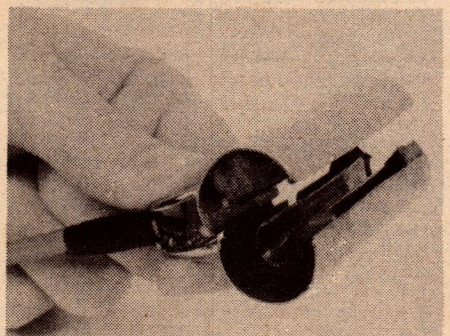
This tachometer has been developed to check the speeds of modern petrol engines. Ignition systems today are many and various; some have no breaker points, while twin cylinder 4-stroke motor cycle engines can have firing on each cylinder as each piston reaches top dead centre. Some multi-cylinder engines divide the ignition lead between two systems. Capacitor discharge ignition systems are in use both in marine outboard engines and in motor cycles. Some have high tension distributors, others use a separate coil for each cylinder.

From all the complexity indicated above, almost the only common factor is high tension feeding a spark plug. Even here there are variations, for spark plugs can have resistors built into them and can have either metal conductor or resistive suppressor-type high tension leads attached.

In view of these complications, it was decided that the tachometer would need to use a capacity-type pickup from the spark plug lead, in order to cope with the widest range of situations. However, when a simple capacity pickup was tried, it was found that false triggering could be produced due to coupling from nearby leads. The HT pulses have short risetimes, and can couple significant energy even via stray capacitance. In order to overcome this problem, a shielded capacity probe has been developed.

Reference to the circuit diagram will show that the coupling capacity pickup is required to charge firstly the self-capacity of the pickup itself and shielded connection cable. This cable is approximately 1½ metres long, giving a self-capacity of 100pF. The coupling capacity of the pickup to a 7mm high tension lead is in the order of 10pF, thus providing a capacitive divider of about 10:1 ratio for the ignition pulses. Should accidental contact be made to the ignition high tension, then provision is made, by means of a spark gap, to limit the voltage rise.





At left is the author's prototype tacho, made using parts on hand. If you are building from scratch, a larger meter and case could be used to advantage. Above is a close-up of the shielded capacitive pickup probe, partly opened.

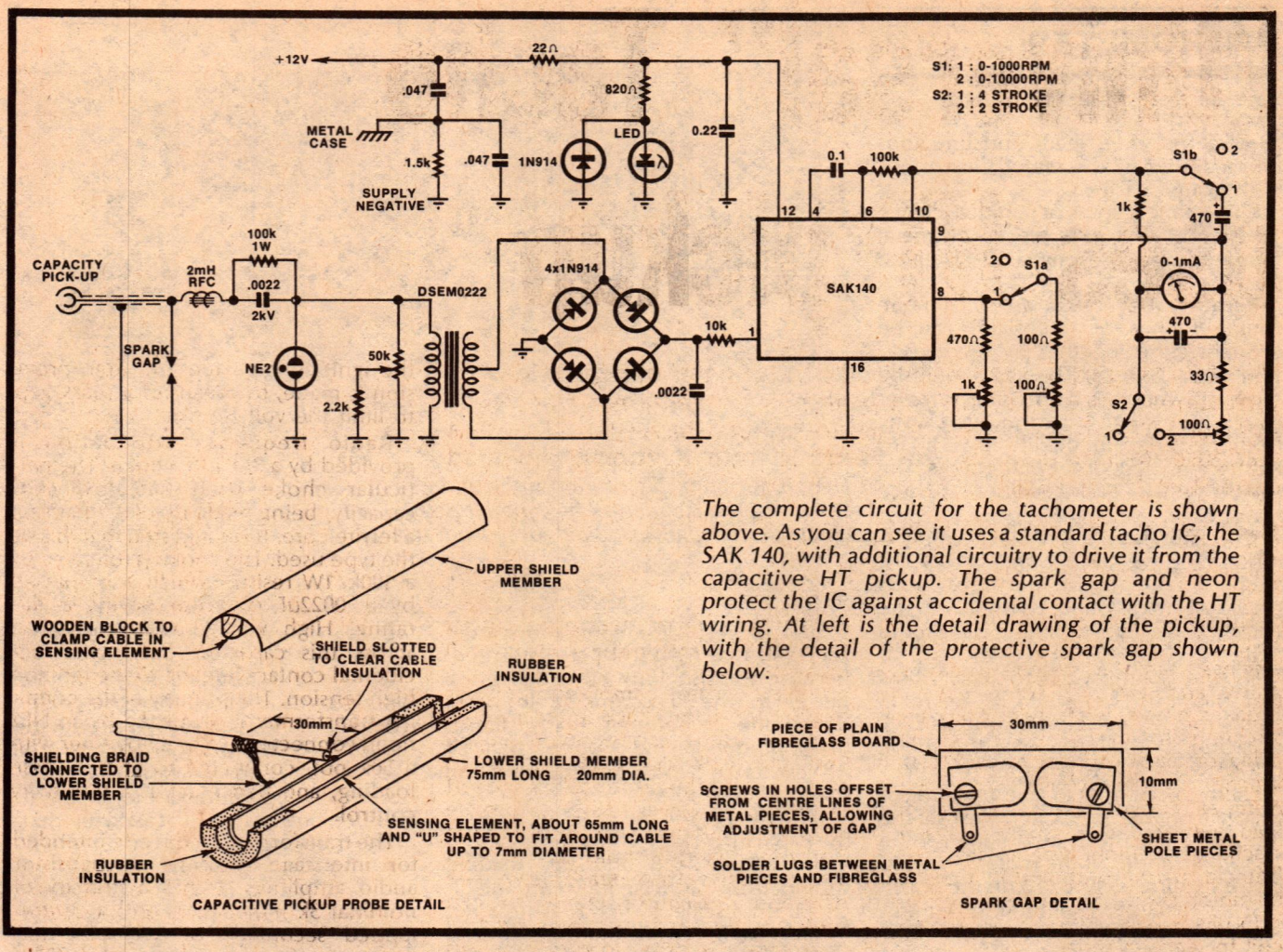
Radio frequency attenuation is provided by a 2mH RF choke. The particular choke used had low self-capacity, being made up of 3 "pies" on a ferrite core. It is suggested that this be the type used. The choke is followed by a 100k/1W resistor which is by-passed by a .0022uF capacitor having a 2kV rating. High voltage will be applied across this capacitor only when accidental contact is made to the ignition high tension. The primary of the coupling transformer is protected by an NE2 neon connected across it, together with a 50k pot. connected to give variable loading, and hence act as a sensitivity control.

The transformer used is one intended for interstage coupling in transistor audio amplifiers. It has a primary of nominal 3k impedance, and a centre-tapped secondary of the same impedance from end to end. The transformer I used came from Dick Smith Electronics, and is listed in their catalog as M-0222.

Half of the secondary is used, to give a 2:1 step down to a full wave bridge rectifier made up of four 1N914 diodes. The output is thus made up of positive pulses no matter what polarity the high tension pulses may be.

A .0022uF capacitor at the output of the bridge rectifier is designed to suppress any RF spikes that may get through. Further protection to the input of the SAK 140 tachometer IC is provided by a 10k resistor. The circuitry around the IC is arranged to make use of non-critical components and to provide ease of calibration. The 100k resistor between pins 10 and 6 and the 0.1uF capacitor between pins 6 and 4 determine the duty cycle. This duty cycle does not exceed 0.8 even at maximum RPM in the two-stroke position.

In the 0-10,000 RPM position, only one 470uF capacitor is connected across the meter. This allows rapid response without excessive needle flicker. However, in the 0-1000 RPM range, flicker becomes very obvious with only 470uF in circuit. This is overcome by switching in an extra 470uF between pins 9 and 10 and arranging extra current drive for calibration in this range by switch S1a. Shunting for



The complete circuit for the tachometer is shown above. As you can see it uses a standard tacho IC, the SAK 140, with additional circuitry to drive it from the capacitive HT pickup. The spark gap and neon protect the IC against accidental contact with the HT wiring. At left is the detail drawing of the pickup, with the detail of the protective spark gap shown below.

calibration in two-stroke mode (or one ignition per rev) is provided by S2.

As the unit draws less than 20 milliamps it can be powered by eight penlight cells in a suitable carrier. The meter is thus portable and can be used even for engines with no battery system. Pickup can be taken from any plug's high tension lead. If the separate battery method is used, a jumper lead will be required between engine and battery negative.

Note that a metal case must be used for the instrument and is connected to the negative supply by means of a 1.5k resistor by-passed by a .047*u*F capacitor.

The prototype was built with what the author had to hand but constructors starting from scratch could use a large meter and case with advantage. However, the general layout of the prototype should be followed with the input leads and filter systems above the meter and the switches, sensitivity control, transformer and integrated circuit below the meter. This is to give maximum separation between input and meter circuits.

Some knowledge of metalworking is required for the construction of the capacity pickup. Use a metal that is readily solderable of approximately 24g. The inner sensing element is "U" shaped, with the diameter such that a 7mm high tension lead slides easily inside the "trough".

The two semicircular halves of the outer shield overlap when closed. The overall length is 75mm and the lower member has a 20mm inside diameter. Two pieces of rubber tubing, each 15mm long were cemented into the lower member and suitably cut to accept the sensing element. Contact cement was used to secure the rubber and to mount the sensing element centrally in the lower member. The rubber is flush with each end of the lower member but the sensing member will be 5mm in from each end.

The clamping mechanism is derived from a 50mm (2in) paper clip, with the jaws cut back and suitably bent. The shielded cable should be prepared as follows:

The prepared cable can be slid under the spring of the paper clip and the cable end soldered to the sensing element. Solder the lower jaw of the paper clip to the lower shield members.

The illustration of the capacity pickup will show that there is a piece of timber 75mm long cemented by epoxy to the upper member. A piece of waterproof plywood was used in the prototype and so shaped that with 7mm high tension cable in the sensing element, the upper shield member just overlapped the lower member. The sides of the piece of plywood were filed away to allow a 4mm cable to be gripped. This is the smallest diameter cable likely to be encountered.

It may be necessary to slot the upper member to clear the cable soldered to the sensing element. With no high tension cable in the sensing element, the piece of plywood can be cemented to the upper member and the remaining jaw of the paper clip soldered to the upper member. It helps to tie the units in position with wire because of the spring loading of the paper clip. The wire ties can be removed after soldering.

Anchorage and earthing of the cable braid is as follows: a tongue of metal about 4mm by 25mm long is soldered to the lower finger grip of the paper clip and faces away from the sensing unit. To this is soldered also the earthing braid of the shielded cable. Then the whole is reinforced by an insulating sleeve and securely taped to the tongue of metal.

If the insulating plastic sleeve can be forced over the tongue of metal, so much the better. The plastic sleeve can be about 65mm long. Its sole purpose is to provide strain relief.

Construction of the indicating unit follows normal practice with the

proviso that inlet leads and functions be separated by the meter dimensions as indicated earlier.

The spark gap is a simple device made up from two pieces of metal mounted on a plain piece of fibreglass board as shown.

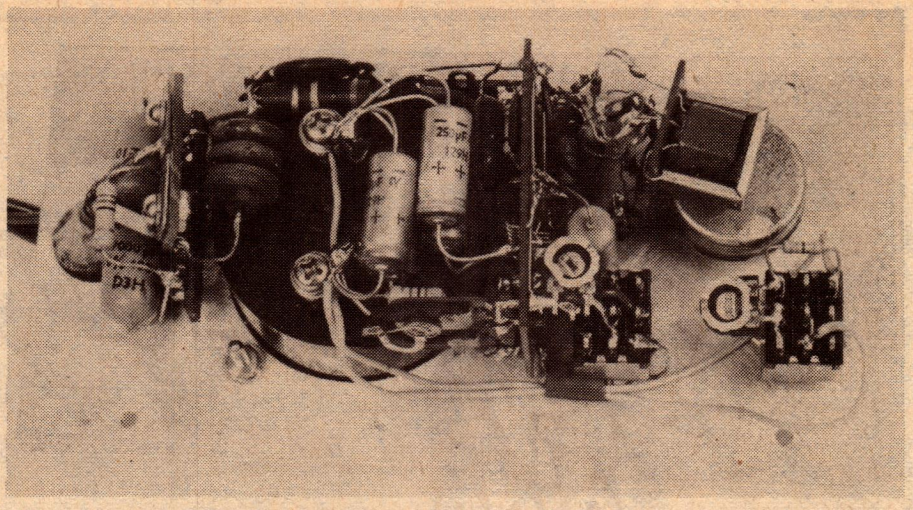
Because the screws are offset, the rounded ends of the plates can be brought close together by slight rotation of each plate. The gap should be made 0.04mm (.0015in) using a feeler gauge. The plates are mounted away from the surface of the fibreglass board by the thickness of the solder lugs. The resulting air gap reduces surface leakage.

For calibration, a 12V 50Hz supply is required as well as a source of 12V DC such as the eight penlight cells previously mentioned. Apply 12V in the correct polarity and the LED should light.

Set the range switch to 10,000 RPM and the function switch to 4-stroke. Apply the 12V 50Hz across the .0022uF capacitor at the output of the diode bridge, via a 10k ½W series resistor.

Set the 1k trimpot to give a reading of 6000 (0.6 on the 1mA scale). Now set the function switch to 2-stroke and set the 100 ohm trimpot of the meter circuit to give a reading of 3000 (0.3 on the scale).

The 0-1000 RPM calibration requires that the unit be taken to a vehicle. If the vehicle is fitted with a six-cylinder engine then proceed as follows. Connect the battery leads of the tachometer to the battery terminals of the vehicle in the correct polarity. The LED should now be lit. Clip the capacity pickup to the lead coming from the high tension of the coil to the distributor. Set the range switch to 10,000 and the function switch to 4-stroke.



Here is a shot of the interior of the author's prototype, showing the general construction. The layout may be varied if desired, but it is advisable to keep the input circuitry and spark gap well away from the IC.

Start the vehicle engine and set the speed so that 6000 RPM are indicated. Because the ignition coil is delivering pulses to the six cylinders in firing order, the tachometer reads this as one cylinder having a speed of 6000 RPM when in fact the engine is set at a speed of 1000 RPM.

With the engine still running, transfer the capacity pickup to any one cylinder high tension lead and the reading should drop to 1000 RPM on the 0-10,000 RPM scale. Switch to 0-1000 and in all probability the meter will read close to full scale. At this stage set the function switch to 2-stroke and set the 100 ohm trimpot associated with S1a to read 500 RPM (0.5 on the scale).

You will note that the calibration method tries to keep readings as close to the initial setting on 12V 50Hz as possible. This reduces the possibility of errors and keeps readings in the mid scale area as accurate as possible. This is the area where the majority of readings will be taken.

If a 4-cylinder engine is used for the low range calibration, then the engine would be set to read 4000 RPM with the capacity pickup on the ignition coil high tension lead. Similarly, 8000 RPM would be used in the case of an eight-cylinder engine. In all cases the sensitivity control is adjusted to obtain readings that are steady.

PARTS LIST

1 Metal case with metal front panel
4 Rubber feet
1 Rubber grommet
1 0-1 milliamp meter
1 Miniature switch, DPDT
1 Miniature switch, SPDT
1 50k ohm potentiometer
1 Knob
1 Capacity pickup (see text)
2 crocodile clips
1 RF Choke 2mH (see text)
1 Spark gap (see text)
1 Transformer, DSE M-0222 or similar
1 LED
1 NE2 Neon
5 1N914 diodes
1 SAK 140 tachometer IC

RESISTORS
2 100 ohm trimpots
1 1k ohm trimpot
1 100k 1W
¼W or ½W 5%:
1 x 22 ohm, 1 x 33 ohm, 1 x 100 ohm, 1 x 470 ohm, 1 x 820 ohm, 1 x 1.5k, 1 x 2.2k, 1 x 10k, 1 x 100k

CAPACITORS
1 .0022uF 2kV ceramic
2 470uF 10VW electro
1 .0022uF 100VW polyester
2 .047uF 100VW polyester
1 0.22uF 100VW polyester
1 0.1uF 100VW polyester

MISCELLANEOUS
Mounting hardware, tap strips, plain Veroboard, PC board pins, solder; 1½ metres of 4mm plastic covered shielded cable, 60pF per metre maximum; 1½ metres each of red and black 2.5mm hookup wire.

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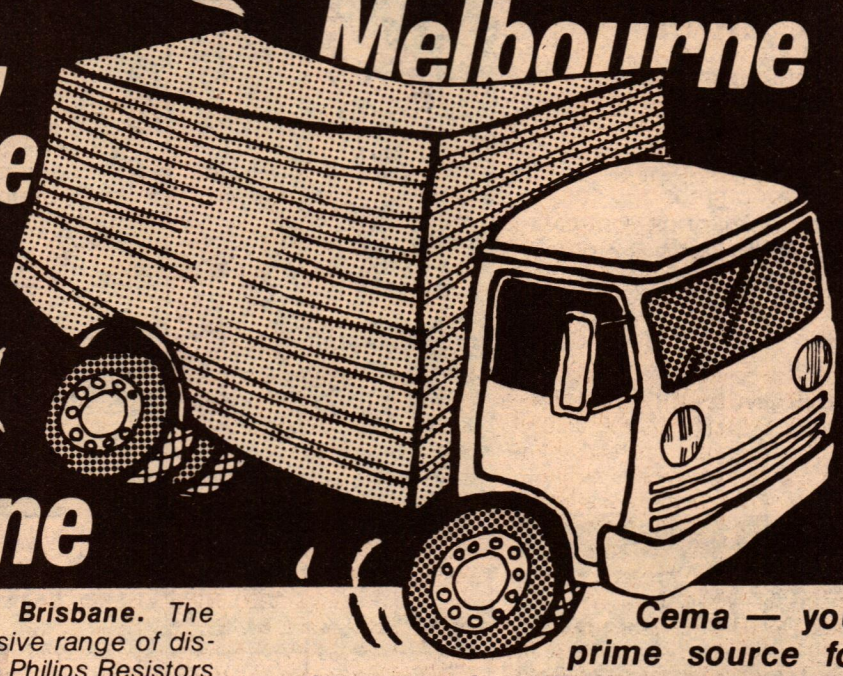

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TRIACS

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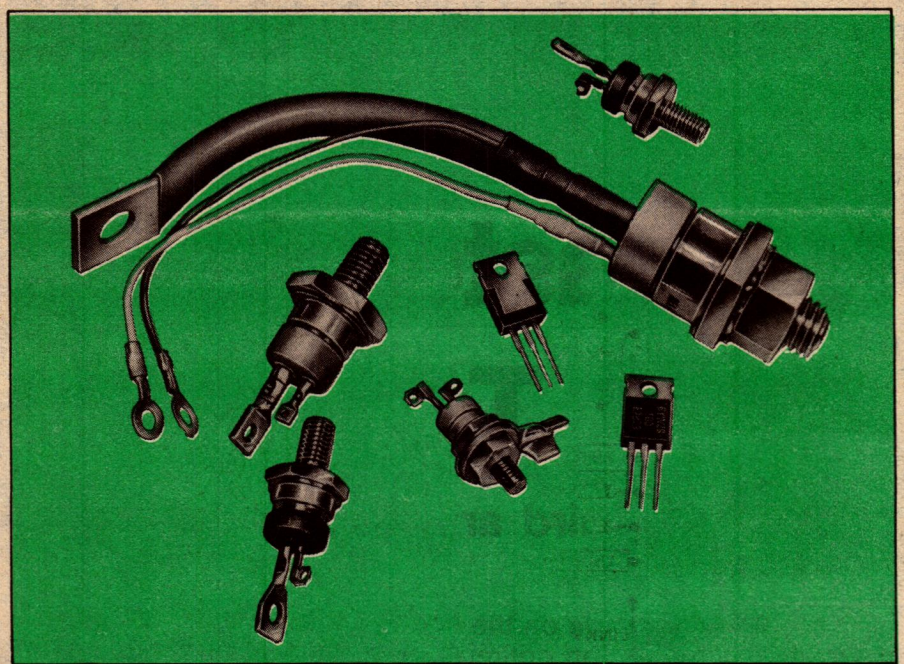
Basic data is given in the accompanying chart.



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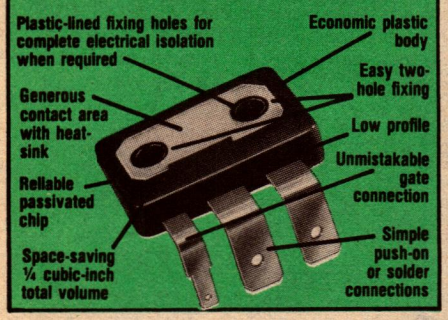

BASIC DATA: In order of current rating

Type No.	Encapsulation	RMS on-state current $I_{T(RMS)}$ max.(1)	Repetitive peak off-state voltage V_{DRM} max.	Non-repetitive peak on-state current I_{TSM} max.	Rate of rise of on-state current dI_T/dt max.	Rate of rise of off-state voltage dV_D/dt max. Normal	Rate of rise of off-state voltage dV_D/dt max. Commutating*	Gate trigger voltage V_{GT} min.	Gate trigger current I_{GT} min.
BT137-500 -600	TO-220 plastic	6A	500V 600V	55A	20A/µs	50V/µs	6V/µs (5A/ms)*	1.5V	35mA
BTW43-600G -800G -1000G -1200G	TO-64 metal (Metric thread)	12A	600V 800V 1000V 1200V	120A	50A/µs	50V/µs	10V/µs (5A/ms)*	2.5V	100mA
BTW43-600H -800H -1000H -1200H		Same as BTW43-600G to BTW43-1200G series shown immediately above except for commutation					10V/µs (12A/ms)*		
BT139-500 -600	TO-220 plastic	15A	500V 600V	115A	50A/µs	50V/µs	4V/µs (8A/ms)*	1.5V	35mA
BTX94-400H -600H -800H -1000H -1200H	TO-48 metal (UNF thread)	25A	400V 600V 800V 1000V 1200V	250A	50A/µs	100V/µs	30V/µs (25A/ms)*	3V	150mA
BTX94-400J -600J -800J -1000J -1200J		Same as BTX94-400H to BTX94-1200H series shown immediately above except for commutation					30V/µs (50A/ms)*		
BTW41-500G -600G -800G	SOT-80 plastic	40A	500V 600V 800V	260A	50A/µs	100V/µs	5V/µs (12A/ms)*	1.5V	75mA
BTW41-500H -600H -800H		Same as BTW41-500G to BTW41-800G series shown immediately above except for commutation					5V/µs (23A/ms)*		
BTW34-600G -800G -1000G -1200G -1400G -1600G	TO-103 metal (Metric thread)	55A	600V 800V 1000V 1200V 1400V 1600V	400A	50A/µs	200V/µs	30V/µs (25A/ms)*	2.5V	200mA
BTW34-600H -800H -1000H -1200H -1400H -1600H		Same as BTW34-600G to BTW34-1600G series shown immediately above except for commutation					30V/µs (.0A/ms)*		

(1) For derating curves see individual data sheets. *The figures in brackets following the dV_D/dt rating show the $-dI/dt$ of the preceding turn-off.

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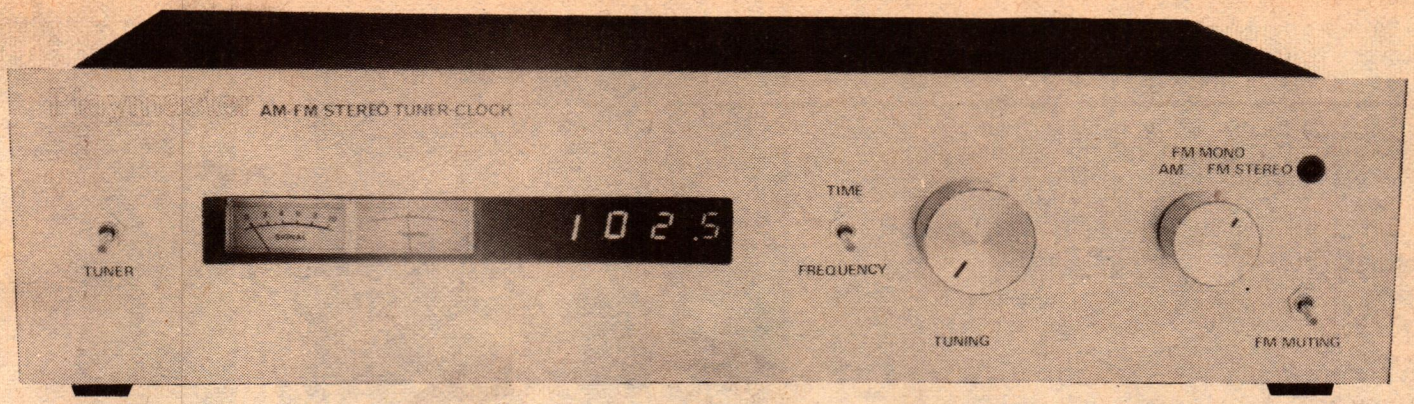


Playmaster AM-FM Stereo Tuner-Clock

third article has a useful trouble-shooting guide

In this third and final article on the new Playmaster AM/FM tuner clock, we give some tips on optimum reception, discuss some of the more likely faults and feature some photographs and PCB artwork held over from the last issue.

by LEO SIMPSON

The previous two articles have provided all the information that should normally be required to construct the tuner and make it fully operational. So now it is appropriate to discuss some features of the unit's operation in order that the best performance is realised by the constructor.

As far as FM reception is concerned, the most important point is the strength of signal fed to the antenna connections. Most people connect their FM tuners to their TV antenna, using a splitter for correct termination. This method should be adequate in most locations, but may prejudice both TV and FM reception in fringe areas, due to the signal losses involved in the splitter. In these cases, separate antennas will be necessary.

A good idea of the signal strength received can be gained by reading the tuner's signal meter and then referring to the meter response graph shown on page 39 of the December 1978 issue. A meter reading of "4", for example, indicates a signal strength of 100 microvolts (across the 300 ohm terminals).

A signal of this order will provide noise-free reception in the mono mode. If the tuner is switched to stereo mode, background noise will be noticeable (as hiss). To eliminate noise from stereo reception, a signal strength of 300uV or more is required. This corresponds to a meter reading of "6" or more.

It is possible that signal strength may be adequate and the reception appropriately noise-free but marred by objectionable distortion. A likely cause of this problem is "multipath" reception, which is akin to "ghosting" in TV reception.

If you suspect that "multipath" reception is a problem, the diagnosis can be confirmed by close observation of the signal strength meter. If the pointer can be seen to be fluctuating in time to the music or voice program, then there is definite indication of multipath. The solution may not be easy but involves the same process used to reduce TV ghosting — selection of a suitable directional antenna and orienting it for best reception. The signal strength meter can be used as an aid in orientation.

Similar remarks can be made about AM reception. While the quality of reception is nothing to become excited about, the AM specifications of this tuner are actually better than those obtained from many commercial tuners. This may be hard to believe, but it's true.

For reasonably noise-free reception the signal strength meter should read "6" or more. If the listener is located in area of relatively weak signals, the tuner and its rod aerial will have to be oriented in order to maximise signal pickup. In areas where very strong signals produce overloading of the AM input stage, the signal pickup can be reduced by pulling the rod closer to the chassis.

It is possible that the aerial rod may need "peaking" to optimise signal pickup. This is done by tuning to a station in the middle of the range and tweaking the aerial rod slug for maximum deflection of the signal strength meter.

Multiplex hash will be audible between stations and will probably interfere with reception of weak stations. This tuner is not really suitable for DX reception of AM, so we do not regard this as a major drawback. Recepton of strong local stations should not be affected.

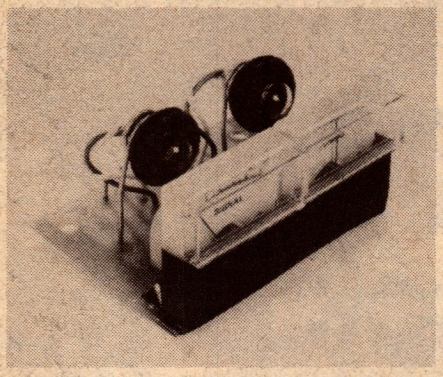
Should you wish to determine whether any interference in the tuner is multiplex hash, you can readily check by depressing both time-setting push-buttons simultaneously. As noted previously, this action blanks the display and will reduce the hash radiation to a low level.

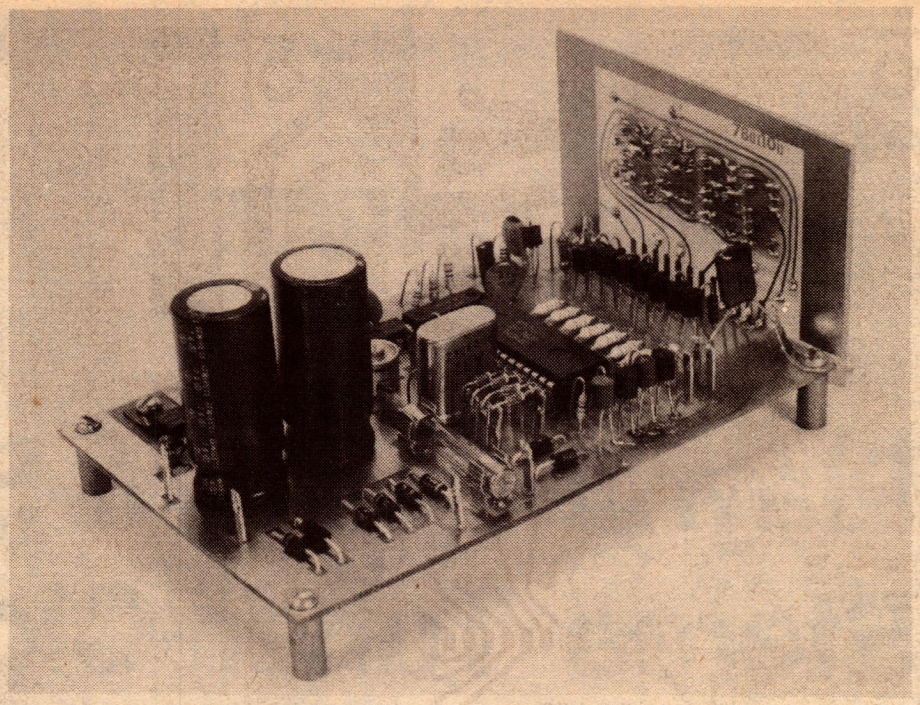
One point we did not mention when writing the earlier articles was the effect of the new AM station spacing of 9kHz which applies as from November 23,

1978. At the time of writing this article (early November) we have not observed the practical effect.

Fortunately, because the Wangine WT-7700 tuner module has a relatively narrow AM bandwidth, the audible effect of 9kHz heterodyne whistles will not be as bad as will be encountered with higher quality AM tuners.

As far as the frequency readout is concerned, the maximum error involved in tuning any one station will be





These photos show the two modules ready for installation in the chassis.

±5kHz. This is because the last digit of the AM frequency display is always zero, a constraint set by the AY-3-8112 IC which was designed to work with AM stations having 10kHz spacing.

Presumably, General Instrument Micro-electronics may eventually produce a frequency readout chip to suit the 9kHz spacing, which now applies to most of the world except for one major holdout, the USA.

The local distributors, General Electronic Services Pty Ltd, have notified General Instrument Corporation of the change.

For the present, the frequency readout error will show up in the following way. For example, Sydney station 2GB, now on 873kHz, will give an indication of 870kHz. And station 2F€, moved to 576kHz from 610kHz, will give an indication of 580kHz.

Constructors may also find that an error occurs with the FM frequency readout. This will be due to an offset error which can be corrected by omitting one or more of the programming diodes D1 to D4.

By using differing combinations of diodes D1 to D4, the FM offset for the 8112 IC can be varied to suit intermediate frequencies from 10.46mHz to 10.76MHz. The table is as follows:

10.76MHz	D1, 2, 3, 4
10.74MHz	D1, 2, 3
10.72MHz	D1, 2
10.70MHz	D2, 3
10.68MHz	D2
10.66MHz	D3, 4
10.64MHz	D3
10.62MHz	D1, 3
10.60MHz	none
10.58MHz	D1, 4
10.56MHz	D1
10.54MHz	D1, 2
10.52MHz	D4
10.50MHz	D3, 4
10.48MHz	D2, 3, 4
10.46MHz	D1, 3, 4

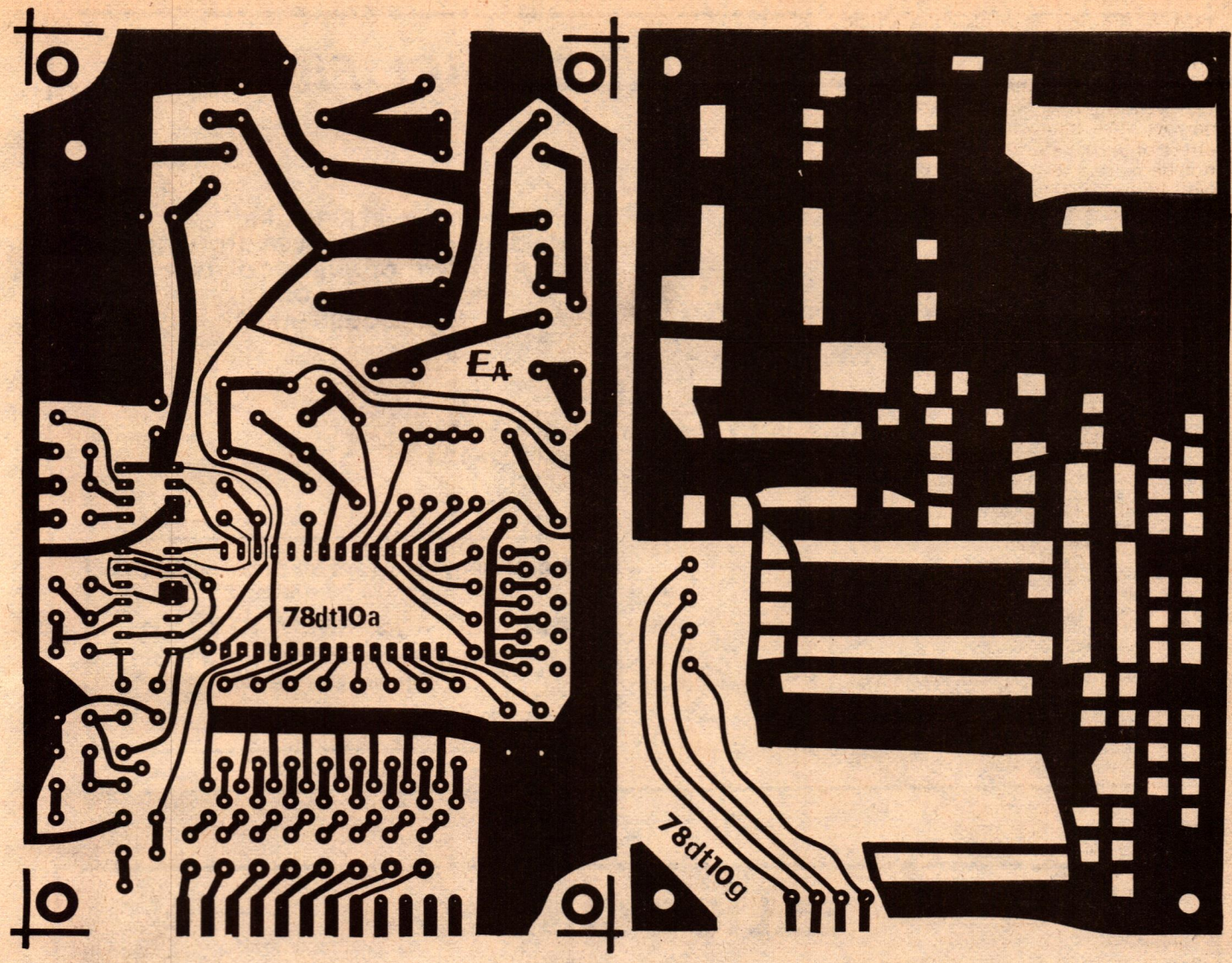
By way of explanation, while most FM tuners have a nominal intermediate frequency of 10.7MHz, the actual IF may be up to several 100kHz above or below this figure. This applies whether or not the IF strip uses ceramic filters. The Murata SFE10.7MA filters used in the Wangine WT-7700 module are manufactured to five specified centre-frequencies, and are coded with a coloured dot:

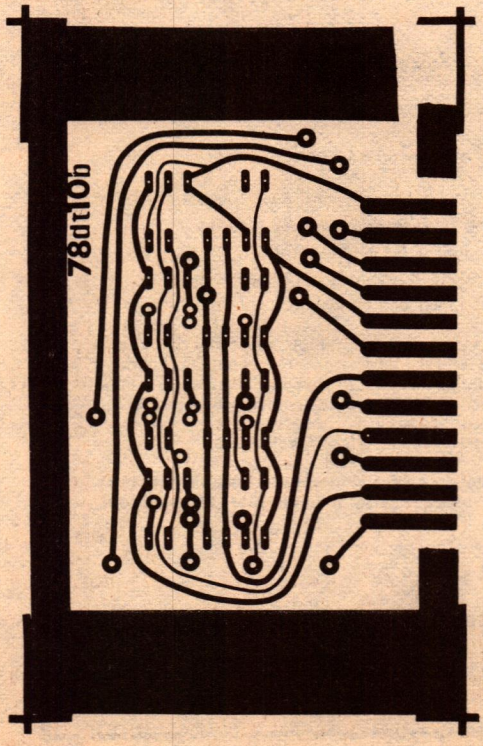
10.80MHz ± 35kHz	Yellow
10.75MHz ± 35kHz	White
10.70MHz ± 35kHz	Red
10.65MHz ± 35kHz	Black
10.60MHz ± 35kHz	Green

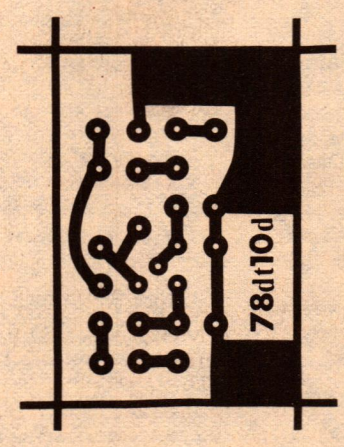
Accordingly, by looking at the colour code dots on the SFE10.7MA filters on your module (they're close to the oscillator shield), you can decide on which combination of diodes to use. Therefore, if the filters are coded with yellow or white dots, D1, 2, 3 and 4 can be left in place. If the code is red, omit D1 and D4. If green, omit D1 to D4.

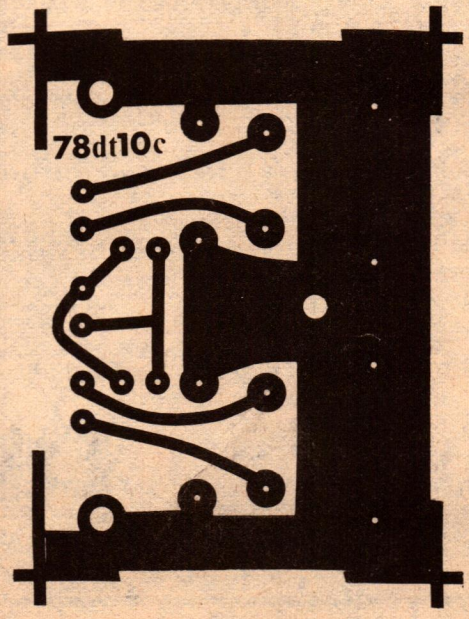
The above selection is fairly rough and ready but is adequate since the 8112 gives a readout of the centre of the channel even if the tuner mistuned by ±100kHz. In any case, the frequency readout is used only as a guide to the tuned frequency. For accurate tuning, the tuning meter must be used.

A more precise method of selecting the programming diodes is to use a digital frequency meter, in the following way. Accurately tune to an FM station of known frequency (using the









These are the patterns for the four PCBs, including the ground plane.

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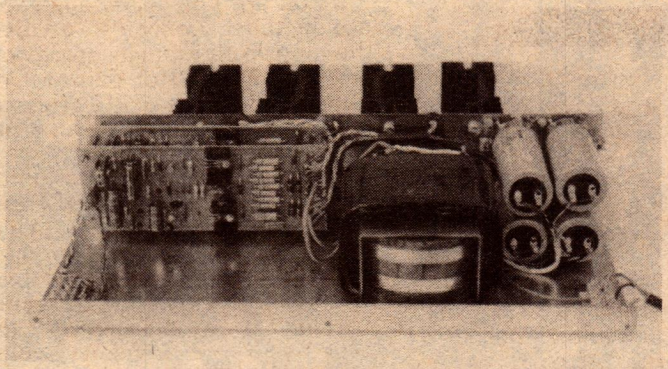

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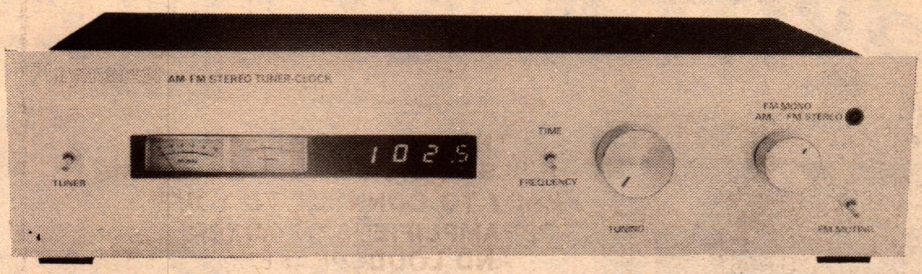


tuning meter). Measure the prescaled frequency at the output of the DS8629 IC (pin 2) and multiply by 100. Now subtract the station frequency to obtain the actual intermediate frequency for the tuner, and select the programming diodes accordingly.

Setting the crystal oscillator trimmer capacitor for accurate time-keeping is a matter of trial and error. Since the clock function has no "seconds" readout, the accuracy of the timekeeping can only be measured by comparing the changeover of the "minutes" digit with the time signals on the radio or telephone.

At the time of writing only a few of the Playmaster tuners have been built and these have been relatively fault-free. However, our experience with these prototypes is a guide to some of the common faults which constructors may come across.

Most of the likely faults will be visually indicated by the digital readout and most of these are likely to be missing segments or missing digits.

First point to remember is that all segment lines are common. The table below shows the pin connections to LT-302 and DL-707 LED displays. The segment and digit connections to the AY-5-8112 are shown on the main circuit diagram published last month. This data enables the segment and digit lines to be checked for continuity, using a multimeter.

pin 1	segment A
pin 2	segment F
pin 3	anode E,F,G,DP
pin 6	decimal point
pin 7	segment E
pin 8	segment D
pin 9	anode C,D
pin 10	segment C
pin 11	segment G
pin 13	segment B
pin 14	anode A,B

Actually, the pin connections for the LT-302 and DL-707 are not exactly the same. With the LT-302, anode pins 3 and 14 are internally connected while pin 9 is used for the right-hand decimal point cathode. This means that a good few of the 15 links on the display PCB are superfluous if the LT-302s are used.

If the displays are very dim, then it is probable that you have inserted the transistors incorrectly. If you are supplied with 2N3904 and 2N3905 transistors their orientation should be reversed to that shown in the photographs. On the 2N3904/5 the leads are in a straight line and reversed in order to that for the BC328/338 series.

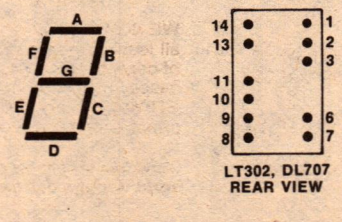
If one segment of one display is missing, the fault lies with that particular display — most probably it is a bad connection. On the other hand, if the "A" segment, for example, is missing from each digit, then the fault could lie with the display, transistor Q5 or the 8112. The latter case is the least likely of the three.

Q5 (and all the other bipolar transistors) can be checked with power applied. Just short Q5 between base and collector (carefully now). If the "A" segments all light up, then Q5 is okay. If not, then Q5 is faulty or there is an open-circuit between Q5 and the "A" segment line. If Q5 proves to okay, check if the "A" segments all light when the base of Q5 is shorted to the base of another segment driver transistor. If they do, there is an open-circuit in the base line to Q5 or the 8112 IC is now a useless piece of plastic.

Note: The display should be set to read "880" on AM or "88.9" on FM in order to be able to check segment operation on the last three digits. On the first digit, only two segments are displayed (ie, for "1").

A similar procedure can be used to cure missing digits.

Under dim lighting conditions, you may notice that when the leading digit should be blanked (for three-digit displays, for example), some segments are glowing slightly. This can be improved by adding another diode in series with D5 and D6. Lift one end of D5 or D6 up and solder one end of the extra diode to the position vacated. Then twist the ends of the two diodes together and solder.



LT302, DL707
REAR VIEW

Does the frequency display work? If not, it could be because the tuner module is not working or because Q13, Q14 or the interface ICs are malfunctioning.

If you are unlucky enough to short out the tuner supply (P12) accidentally, the most likely casualty apart from the fuse, is the regulator transistor on the tuner module, near P12. This can be replaced with a TIP31, which has the same lead configuration.

If the FM display becomes unreliable or intermittent as the tuned frequency goes higher, it is likely that Q14 is a little low in gain. The situation can be cured by reducing the 220 ohm resistor from Q14. The resistor should be reduced to the point where the display is reliable over the whole frequency range. Do not reduce it more than necessary, otherwise multiplex hash will become a significant component of the residual noise.

If the FM display shows "189.3" either Q14 or the 8629 IC is not working at all. Similarly, if the AM display shows "1550", either the 7400 IC or Q13 is not working. In both cases, check that the inputs from the respective local oscillators are actually connected. Apart from this, the easiest way to check these parts of the circuit is by substitution.

One other fault which occurred with one of our prototype modules was failure to operate in the stereo mode. This proved to be due to maladjustment of the multiplex decoder (HA1156) internal oscillator, probably as a result of an inadvertent nudge to the 10k preset potentiometer (associated with pin 14). This can be adjusted precisely with the aid of a frequency meter so that the output at pin 10 is exactly 19kHz.

Another method which will give reasonable results is as follows: Set the tuner to receive a station known to be transmitting in stereo. Now tweak the 10k pot (with 15k resistor adjacent) so that the stereo beacon lights. Continue turning the pot until the LED extinguishes. Now set the pot wiper in the middle of the range for optimum results.

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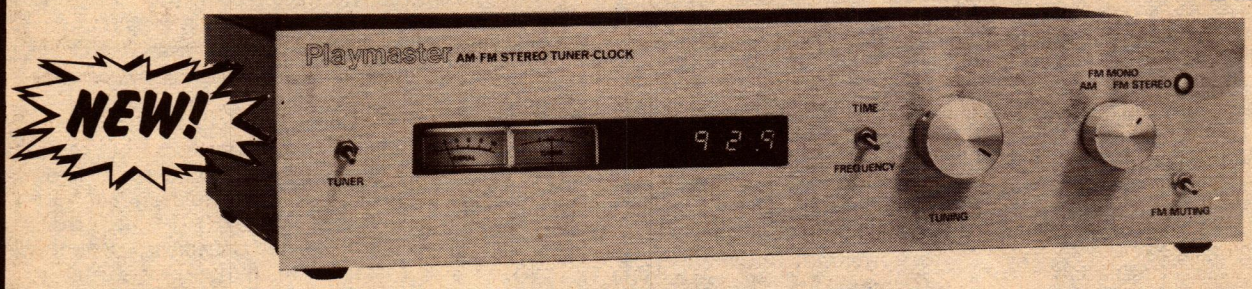

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Build this useful test instrument

Direct reading capacitance meter

Following on from our direct reading capacitance meter of about two years ago, here is an updated version which should be equally as useful as its predecessor and just as popular.

by IAN POGSON

In October 1976, we described a Direct Reading Capacitance Meter which became a very popular piece of test equipment. Because of its success, we decided to have another look at it with the idea of updating the design and making any improvements desirable in the light of intervening experience.

The original unit was not built on a printed board; instead, we made use of a piece of general-purpose DIP board. Obviously, it would make it neater and easier to build if we used a custom PCB and this is one improvement which is very worthwhile. Similarly the case which we used to house the original was quite a good one, but it is now rather expensive and so we looked around for a case which was more modestly priced but would do the job just as well. The ever popular "zippy box" filled the bill and this is what we have used for the new meter.

Another idea which seemed worth considering was to use a 100uA meter instead of the 50uA unit. This would give decade readings which would possibly be more in keeping with present day usage. However, investigations along these lines revealed that the system would not fully drive a 100uA movement, so that idea had to be passed over.

After our first unit was described one of our readers, Mr B. M. Byrne, of Indooroopilly, suggested some modifications in the light of his experiences with it; his suggestions were given in Circuit & Design Ideas for July, 1977. Interested readers may wish to refer to Mr Byrne's comments.

Our own experience in making up the new unit is that we have found that it was better to leave the resistor values as for the earlier circuit. It would seem that there are a number of hidden factors, possibly layout, etc, which can affect the two lower ranges. We have found that a very satisfactory way out of the problem is to add a couple of extra calibrating trimpots.

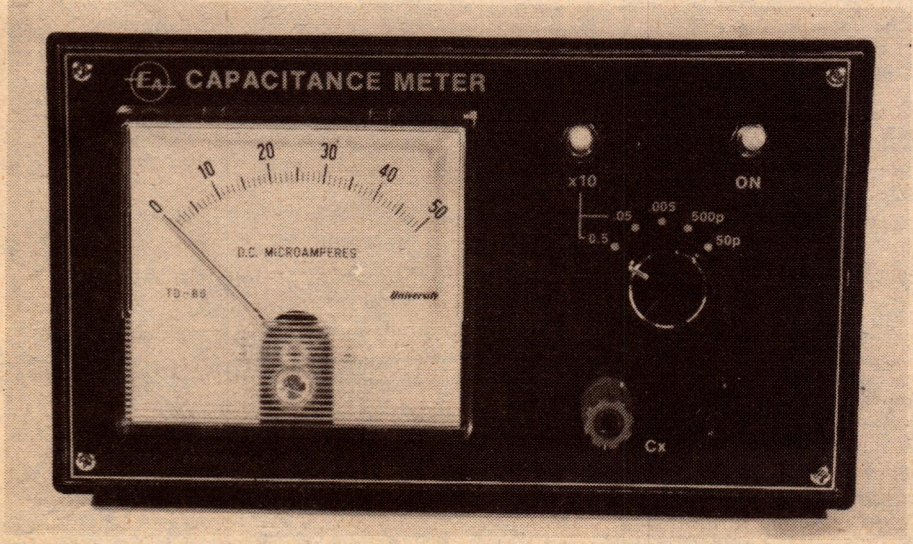
Modifications aside, this little capacitance meter is a most useful device for anyone making use of capacitors. Most of us have a box of assorted capacitors, some good, some doubtful and more than likely quite a number without any capacitance marking. For sorting out such a box of capacitors this capacitance meter is invaluable.

The unit effectively has six switched ranges. Capacitance measurements from as low as 1pF and up to 5uF are possible. Low values, below about 10pF, may be subject to a certain amount of inaccuracy. This is not unusual in simple types of capacitance measuring devices.

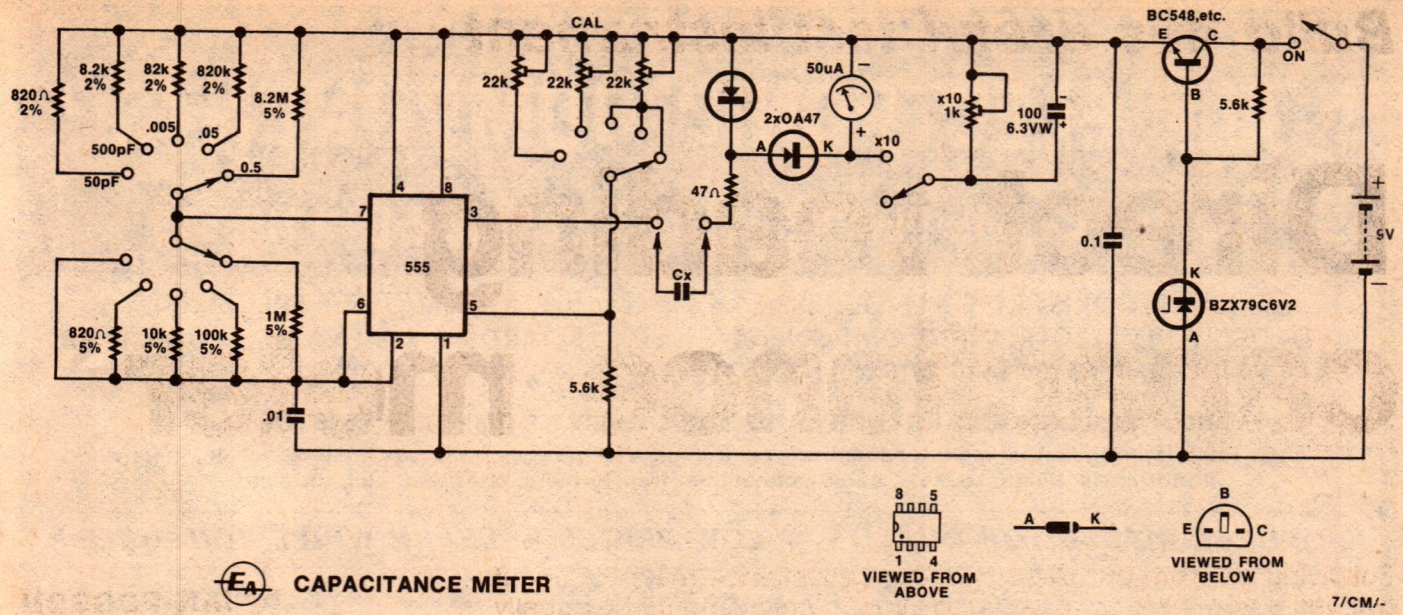
In addition to measuring ordinary capacitors, it is possible to measure electrolytics as there is a potential difference between the two terminals amounting to a volt or two. The polarity must be observed of course. Also, this potential difference makes it possible to measure the reverse biased capacitance of diodes, at the voltage appearing across the terminals. This is not all. Such other capacitance measurements as the junctions of transistors, coaxial cable, etc may also be made.

As may be seen from the circuit and pictures, the device is quite simple. It follows that the cost is quite modest by current standards. The operation of the circuit centres on the very popular 555 timer IC. I will give a very short description of the operation, but for readers who would like to go into this at greater depth, I suggest that you refer to the original article by Mr Willcox, in the May 1976 issue of "Television".

The two resistors selected by the



A low-cost plastic "zippy" case was used to house the prototype.



CAPACITANCE METER

7/CM/-

range switch, together with the .01uF capacitor and part of the 555 timer, form an oscillator. After undergoing switching in other parts of the 555 timer the output emerges at pin 3 in the form of pulses. One part of the pulse is discharged through capacitor Cx, via the diode to the supply rail. The other part of the pulse discharges through the other diode and the meter. These pulses are integrated by the meter and give a reading in accordance with the capacitance Cx.

Calibration is achieved by adjusting the three 22k trimpots. One is common to the three highest ranges and need only be adjusted on one of those ranges. The other two trimpots are used for the two lower ranges, giving separate adjustments for each.

In the earlier version of the capacitance meter we specified close tolerance resistors for the oscillator ranges. The need still applies for the three highest ranges, as they are controlled by one calibrating trimpot. However, the other two ranges may not need such close tolerance resistors, as separate adjustment is provided for each. We have retained the close tolerance resistors on the circuit diagram and in the parts list, but readers may decide whether or not they adhere strictly to these.

In the bottom row of oscillator resistors it may be seen that three of them relate by a factor of 10, but the fourth resistor is reduced to 820 ohms and the fifth position is reduced to a link. These are due to the effective resistance presented by the IC at pin 7.

To increase the top range measurement of 0.5uF by a factor of 10, a shunt in the form of a 1k trimpot is switched across the meter. Due to the low frequency of the oscillator on the top range the pointer of the meter is inclined to "jitter", so a 100uF electrolytic capacitor is also switched across the meter to eliminate this effect. Of course, when switching out the x10 facility, the jittering effect remains on the top range. It is not serious, but if you wish, the next lower range may be selected and the x10 switch added, again resulting in a 0.5uF range but with smooth meter operation.

To maintain accuracy of measurement, it is necessary to keep the supply voltage at a steady value. To this end, we have used a simple voltage regulator consisting of a 6.2V zener diode and a BC548 (or similar) transistor. It was found that this arrangement was slightly unstable under certain conditions and the 0.1uF bypass capacitor was added to cure this tendency.

The supply for our unit is derived from a small 9V battery, regulated as just described. If you wish to operate the unit from the mains, then the battery may be replaced by a suitable transformer, rectifier diodes and a large value electrolytic capacitor. However, we are of the opinion that this type of unit is better supplied by a battery, thus giving greater freedom and flexibility.

The matter of components can present problems in availability but there should be little or no trouble with this

LIST OF COMPONENT PARTS

1 Zippy box, 196mm x 113mm x 60mm
1 Printed circuit board, 89mm x 76mm, code 78CII
1 50uA Meter, 86mm x 78mm (see text for alternative)
1 Rotary switch, 2 sections 2-pole 5-position
2 Miniature toggle switches, SPDT
1 Knob
2 Terminals type D64, 1-red 1-black
2 Banana plugs
2 Crocodile clips
1 9V battery No 2362
1 555 IC 8-pin DIL
1 IC socket, 8-pin DIL (optional)
1 BC548 transistor or similar
1 Zener diode BZX79C6V2
2 OA47 germanium diodes

RESISTORS
(½ watt)
1 47 ohms
1 820 ohms 2%
1 820 ohms 5%
2 5.6k
1 8.2k 2%
1 10k 5%
1 82k 2%
1 100k 5%
1 820k 2%
1 1M 5%
1 8.2M 5%
1 1k Philips miniature trimpot, horizontal mounting
3 22k Philips miniature trimpots, horizontal mounting

CAPACITORS
1 .01uF greencap
1 0.1uF greencap
1 100uF 6.3VW electrolytic

MISCELLANEOUS
Hookup wire, solder, solder lugs, clips for battery.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

project. The zippy box is available from Dick Smith Electronics stores and many other suppliers. As usual, copies of the artworks for the printed board and the front panel label will be distributed to various suppliers and these items should be readily available.

If you wish to make your own printed board and front panel label, we can supply the usual dyeline transparencies through the Information Centre.

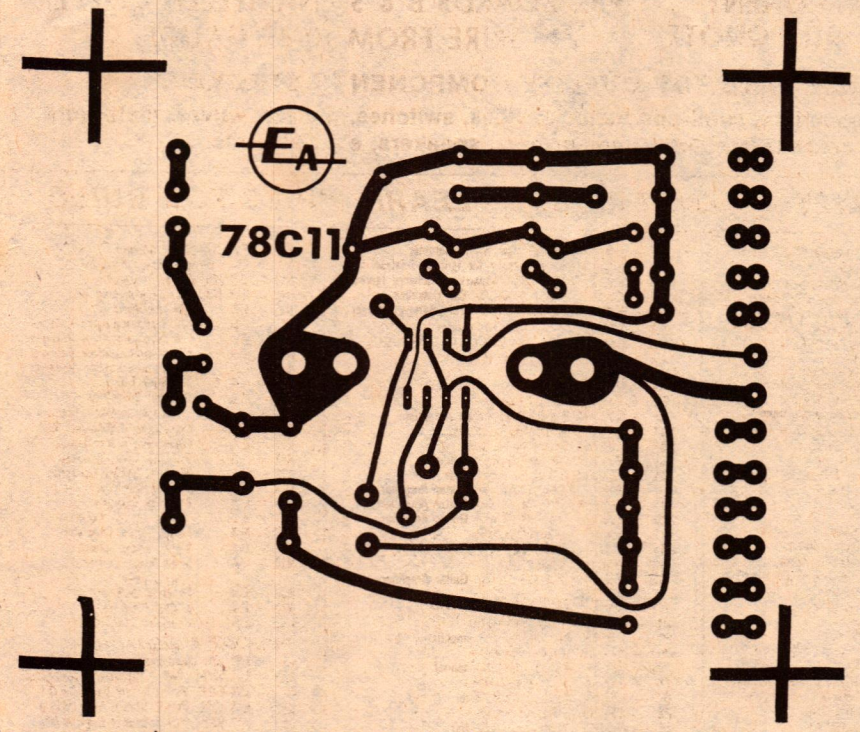
The meter which we have used on the prototype is one imported by University Graham and it should be available through most components sellers. On the other hand Dick Smith Electronics offer a much smaller meter which would also do the job. Naturally, if you elect to use this smaller meter but still use the same box, then the different mounting requirements will have to be taken into account. The terminal centres on the back of the small meter are closer than for the larger meter, but we have provided for this on the printed board.

The close tolerance resistors for the prototype were obtained from Radio Despatch Service, but these should also be available from most components sellers. OA47 or similar gold bonded germanium diodes are required, but supplies of these seem to be readily available.

Construction is quite straightforward and should present no difficulties. Most of the components are accommodated on the PCB and this in turn is mounted on the back of the meter by means of the two terminals. The range selector switch, the two toggle switches and two terminals are mounted on the front panel. The battery is accommodated on the bottom of the box at one end.

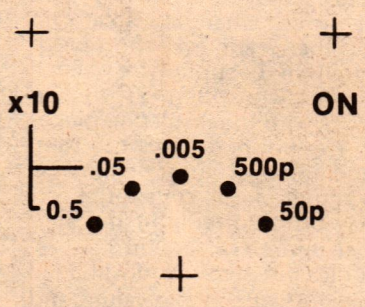
The usual precautions should be observed. Care should be taken to make good soldered joints and not to overheat the components in the process. Also, it is important to observe the polarity of such components as diodes, transistors, electrolytic capacitors and the IC. With regard to the IC, we used a socket for it but if you wish, it may be dispensed with providing care is taken when soldering it in place.

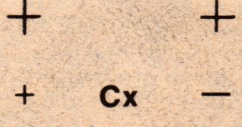
Having completed the assembly of



Here are actual size reproductions of the PC pattern and front panel artwork.

EA CAPACITANCE METER





the printed board, it should be carefully checked to make sure that there are no errors or omissions. Leads of hookup wire should now be soldered to all points on the board, with sufficient length in each case so that they will reach the external destination point. When wiring the range switch for the resistors, I used different colours of wire for each range with the same colour for the two sides of the switch. This makes wiring and subsequent tracing easier.

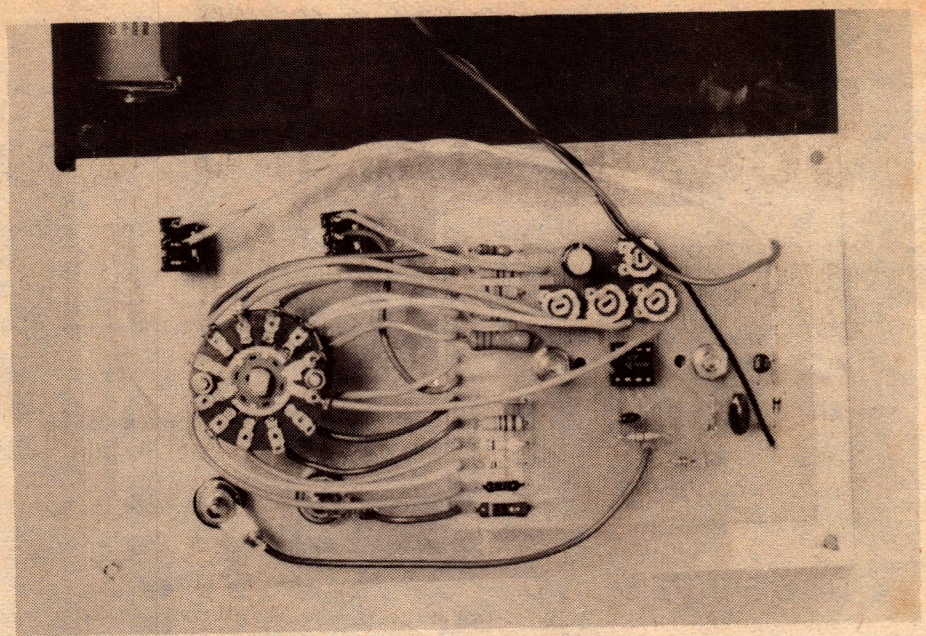
The meter may now be fixed to the front panel and the printed board assembly may be screwed to it. The switches and terminals may also be fixed to the panel prior to doing all the interwiring.

On the range switch, I used the wafer nearest to the panel for the two sets of resistors. The other wafer also has two sections but only one is used. The three calibrating trimpots are wired to this section, one trimpot being used for the three highest ranges and a trimpot each for the other two ranges.

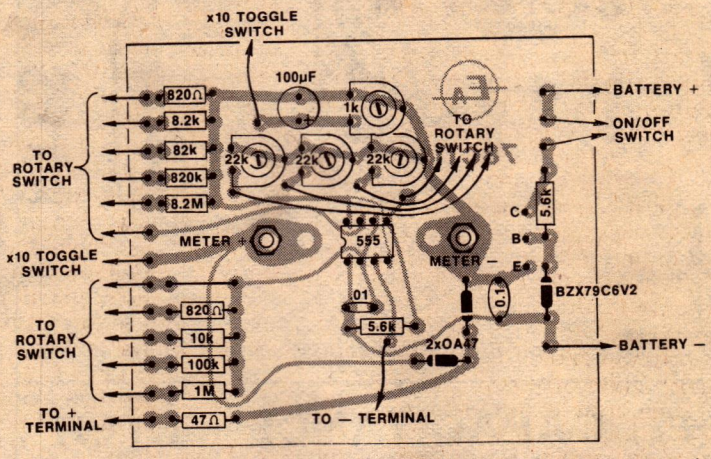
The leads to the two test terminals should be taken as directly as possible, but they should also be kept away from other near objects and from each other. This will keep stray capacitance to a minimum, which could become significant on the lowest range. Having done the external wiring it is a good idea to check over it before proceeding.

With all the rest of the unit now completed, you will find that the battery will just fit nicely into the bottom of the box at the end nearest the switches. Also, as an extra facility, I made up a pair of crocodile clips with plugs attached. I obtained a pair of clips and dispensed with one handle insulator in each case. I then soldered a short piece of 16 gauge tinned copper wire to each one. The clips were then screwed to banana plugs with the insulating pieces removed. The finished items can then be plugged into the tops of the terminals as required. Of course the terminals may be used without the clips when this is more convenient.

To calibrate the meter, you will need some capacitors of suitable values and close tolerance. You will need at least one capacitor which will give a close to full scale reading on one of the three highest ranges, preferably not the highest range because of the wider tolerance in the 8.2M resistor. A capacitor of say, .047uF or .0047uF would be satisfactory. With the capacitor in place, the three 22k trimpots set to mid travel and the range switch set to the appropriate range, switch on and adjust the trimpot so that the correct reading is given on the meter. The other two ranges controlled by this trimpot should also be correct.



Inside view of the prototype showing how the PC board is mounted across the meter terminals. Note routing of leads to the two test terminals.



The component overlay diagram shows the PC board as viewed from the component side. Take care to ensure correct orientation of polarised components.

The other two ranges should also be calibrated in the same way. A 470pF and a 47pF capacitor could be used to calibrate the respective ranges as before, by adjusting the appropriate 22k trimpot.

In addition to the above calibrations, we still have to calibrate the x10 multiplier. To do this, the range switch is set to the 0 to 0.5uF range. You will need a capacitor of known value close to the maximum scale reading of 5uF. The 1k trimpot is set so that the reading on the meter scale corresponds with the value of the calibrating capacitor. The capacitance meter is now ready for use.

In using the meter, one precaution should always be taken. Before adding a capacitor to the Cx terminals, the range switch should be rotated to the extreme left or 0 to 0.5uF position. If this is not done and a large capacitor is connected to the terminals, the meter will be "slammed", which is a practice which should be avoided as much as possible. Another point which should be noted is that the x10 multiplier should only be used with the 0 to 0.5uF and the 0 to .05uF ranges. Errors could be experienced with the lower ranges.

It should also be noted that there is a small zero error on the lowest range. Without the clips plugged in, the prototype gives a zero error reading of 1.5pF and with the clips plugged in the error increases to about 1.8pF. Very low capacitance measurements are subject to some error, particularly below about 10pF. However, experience will soon establish what these errors are and they may be allowed for.

It can be an interesting procedure to take a handful of capacitors, including some electrolytics, diodes, transistors, coaxial cable, etc, and make some measurements. This will soon show just how useful our little capacitance meter can be.

Special opening offer to EA readers:

Sensor Tech's solar arrays now in Australia

Silicon solar power cell arrays made by the experienced US firm Sensor Technology are now available in Australia via distributors Amtex Electronics. To promote the product range, Amtex and our reader offer department are offering readers a special introductory price on a useful 14.4V/4.3W battery charging array.

Although silicon solar cells are not as yet cheap enough to make solar electricity directly competitive with mains power, they're getting cheaper all the time. And as this happens, more and more practical applications are opening up.

At first, solar arrays were only used by public utilities to power remote telephone exchanges, microwave repeaters and railway signalling circuits. But as prices fall they're being used for an ever-increasing range of more mundane jobs — both big and small.

In Nebraska, for example, a massive irrigation project near Mead is using an array of 120,000 cells from Sensor Technology. The array produces 25kW peak in summer, and is used to power a 10hp pump which irrigates 32 hectares of corn and soybeans. During winter the same array is used to power crop driers and dehumidifiers.

A much smaller Sensor Technology array with only 60W peak output is being used to power a mobile receiving set used for tracking satellites in the Arctic Circle. Similarly a 300W peak array from the same firm is being used to power the instrumentation package on an off-shore data collection platform.

Sensor Technology has of course also supplied many arrays for powering remote communications terminals. Three systems with 1000W peak output have been installed in the Bahamas, replacing diesel-driven generators powering part of the islands' telephone system. Similarly the US Air Force is using 220W peak Sensor Tech arrays to provide dependable power for isolated defence communications repeaters.

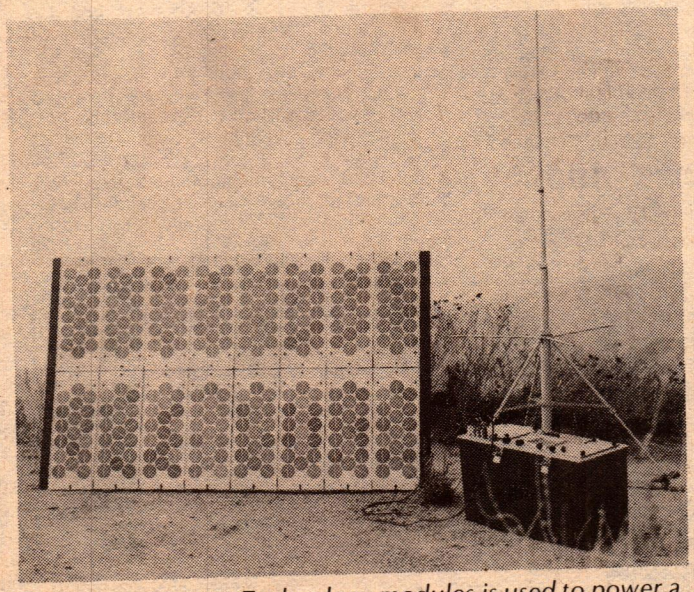
A great deal of practical experience is thus behind Sensor Technology's range of solar arrays, to help ensure that they are capable of efficient and maintenance-free operation. And Australian users will now be able to take advantage of the experience generated to date, now that the firm's products are being distributed here by Sydney firm Amtex Electronics.

The range of solar array modules available covers five basic models. Two give a nominal 7.2V output, for use with 6V accumulator systems, while the other three give a nominal 14.4V output for use with 12V accumulators. The two 7.2V modules give 3.6W and 4.32W peak output respectively, while the 14.4V modules give 2.16W, 4.32W and 8.4W peak output respectively. Each model is available with either tempered glass or Lexan covering, and either with or without a built-in Schottky diode to prevent the batteries from discharging back through the array in darkness.

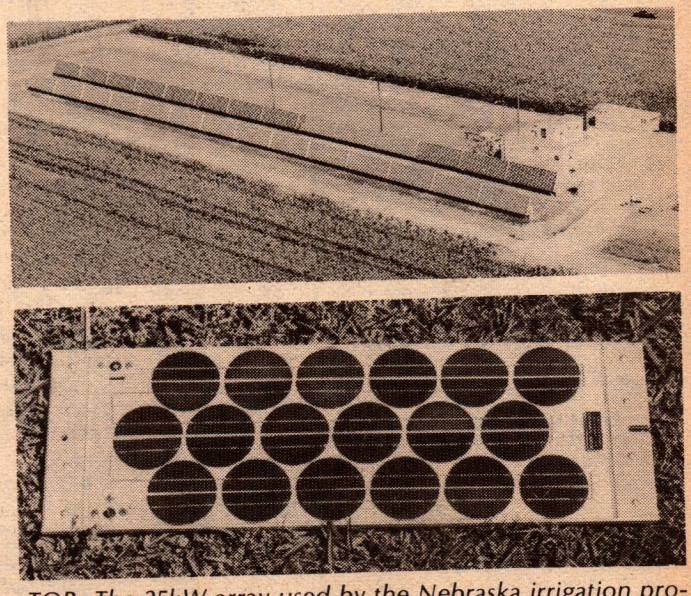
As a special introductory promotion, Amtex Electronics is offering EA readers the 14.4V/4.32W array type 2036EDG at a reduced price of $147.00 plus $5 for certified post and packing. This price includes 15% sales tax.

The array is fitted with a tempered glass cover plate, and has a built-in series Schottky diode. It measures 483 x 165 x 29.3mm, and is built in a sturdy cast aluminium frame which also serves as a heat dissipator.

Information on Sensor Technology products is available from Amtex Electronics, PO Box 285, Chatswood 2067. Details of the offer are given elsewhere in this issue.



This array of Sensor Technology modules is used to power a mobile satellite tracking receiver.



TOP: The 25kW array used by the Nebraska irrigation project. ABOVE: The 14.4V/4.32W module being offered.

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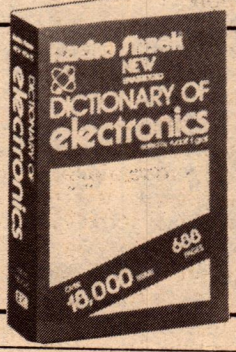

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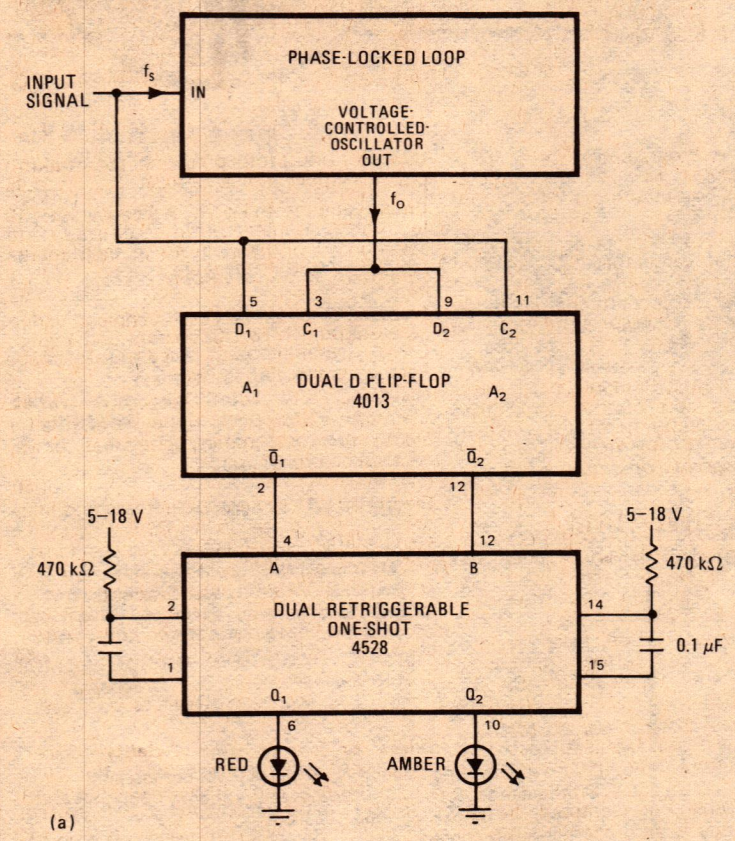
Circuit & Design Ideas

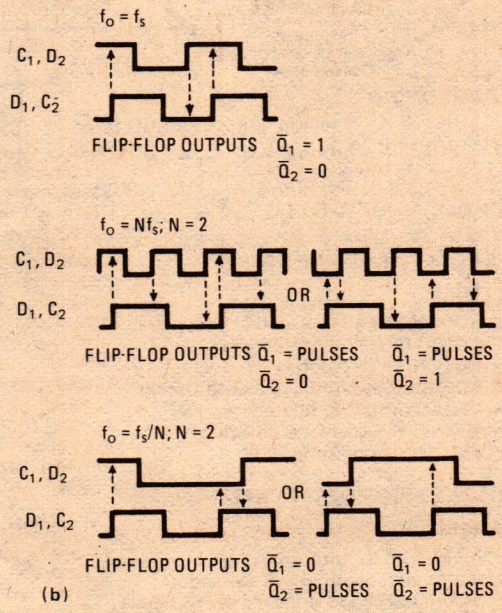
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

D flipflops sense locked state of PLL



(a)



(b)

LOCKED STATE	RED LED	AMBER LED
OUT OF LOCK	ON	ON
LOCKED ON f_s	OFF	OFF
LOCKED ON Nf_s	ON	OFF
LOCKED ON f_s/N	OFF	ON

(c)

This circuit uses a dual D flip-flop to sense the locked state of many popular phase-locked loops, such as the Signetics 562 and 565. By adding a dual one-shot and LED combination to the flip-flops, the circuit visually indicates locking for the conditions where the output frequency fo is locked to the input signal fs, to its harmonics Nfs, or to its subharmonics fs/N.

The circuit shown in (a) determines whether a fixed (that is locked) relationship between fs and fo exists by employing both flip-flops in a simple phase detector. The fs signal drives the D input of flip-flop A1 and the C input of A2, and the fo signal emanating from the voltage-controlled oscillator output of the PLL drives C1 and D2. The design of the phase detector accommodates a PLL having a phase comparator that can generate an upper and lower fs-to-fo phase displacement of 180° and 0° respectively, for the locked condition. The comparator does this by deriving an fo that is displaced 90° with respect of fs when the loop is in the centre of its range.

The circuit response for a constant fo and fs may be understood with the aid of (b). Because the D flip-flops read the data signals (Di) on the positive edge of each clock (Ci), whenever the data frequency fdi equals the clock frequency fci, Q1-bar and Q2-bar of the 4013 remain fixed at either logic 1 or logic 0, depending upon whether the signals at Ci and Di are in phase or out of phase. In either case, the output from the corresponding edge-triggered one-shot in the 4528 will be zero.

When fc is an integral multiple of fd, or fd is an integral multiple of fc, there will be a pulsed output signal from one of the output ports of the 4013 and a corresponding signal at the 4528 to light the LED. Note that because the one-shot is retriggerable, its output will be constantly at logic 1 for a pulsed input signal. The output (logic 1 or logic 0) from the other port of the flip-flop will be constant. When fo and fs are out of lock, each flip-flop reads random 1s and 0s, causing pulsed output signals to appear at both ports of the 4013. The table (c) summarises circuit operation.

In cases where it is necessary to detect only the condition fo = fs, a simpler monitor can be constructed using only a single D flip-flop and one LED that is connected to its Q-bar output. The LED will light whenever fo = fs.

(By L. W. Shacklette and H. A. Ashworth, in "Electronics".)

Novel variable power supply has many uses

This variable voltage power supply is being used by my son to power his slot car set and other small electric toys. The reference voltage (2V) is supplied by the voltage drop across the green LED

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8" 3-WAY SYSTEM AD 8K30 SPEAKER KIT $205.00 pair

Consisting of:
AD12K12SK Speaker Kit $200.00 Pair
AD12K12TK Timber Kit $ 89.00 Pair
Buy Speaker and Timber Kit separately or together for $289.00 Pair (AD12K12)

AD12K12SK SPEAKER KIT contains:

2 x AD0140/T8 1" Tweeters
2 x AD5060/SQ8 5" Mid Range
2 x AD12100/W8 Woofers
2 x ADF500/4500/8 Crossover Networks
2 x Level Control Modules,
Wood Glue, Woodscrews, Damping Material, Caulking Compound.

AD12K12TK TIMBER KIT contains:

2 x Enclosure kits with walnut grain material "Wrap-Around" walls, black stained baffles and backs and grille cloth assemblies, with black grille cloth.

TOOLS REQUIRED FOR COMPLETION
1 x Screwdriver, 1 pair of Scissors
Optional: Hammer and nail or small drill

SPECIFICATIONS

Power Handling Capacity: 40 watts RMS per channel
Impedance: 8 OHMS Crossover Frequency: 500 and 4500 Hertz Enclose Volume: 62 litres (2.2 cu. ft.)

Enclosure Dimensions:	Height	Width	Depth
	720 mm	460 mm	261 mm

No electronic knowledge required to construct these enclosures.

Woodwork completely pre-cut and veneered.

Consisting of:
AD8K30SK Speaker Kit $141.45 Pair
AD8K30TK Timber Kit $ 63.55 Pair
Buy Speaker and Timber Kit separately or together for $205.00 Pair (AD8K30)

AD8K30SK SPEAKER KIT contains:

2 x AD0140/T8 1" Tweeters
2 x AD5060/SQ8 5" Mid Range
2 x AD8066/W8 8" Woofers
2 x ADF600/4000/8 Crossover Networks
2 x Level Control Modules, Wood Glue, Woodscrews, Damping Material, Caulking Compound.

AD8K30TK TIMBER KIT contains:

2 x Enclosure Kits with walnut grain material "Wrap-Around" walls, walnut grain baffles, black backs and grille cloth assemblies with black grille cloth

TOOLS REQUIRED FOR COMPLETION:
1 x Screwdriver, 1 x Pair of Scissors.
Optional Hammer and nail or small drill.

SPECIFICATIONS

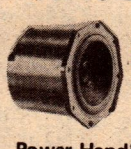
Power Handling Capacity: 40 watts RMS per channel
Impedance: 8 OHMS Crossover Frequency: 600 and 4000 Hertz Enclose Volume: 27 litres

Enclosure Dimensions:	Height	Width	Depth
	550 mm	340 mm	245 mm

SEPARATE SPEAKERS and CROSSOVERS

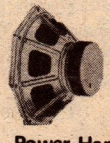
AD 0160/T8
1" High Fidelity Dome Tweeter
$13.00

Power Handling Capacity:
20 W rms with 1600 Hz cross-over filter ADF 1600/8.
40W rms with 4500 cross-over filter ADF 500/4500/8
Impedance: 8 OHMS
Resonance Frequency: 1 kHz
Frequency Range: 1.5–22 kHz



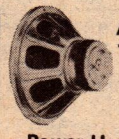
AD 5060/SQ8
5" High Fidelity Mid Range
$18.00 ea

Power Handling Capacity:
40 W rms with cross-over filter ADF 500/4500/8
Impedance: 8 OHMS
Resonance Frequency: 210 Hz
Frequency Range: 180 Hz–10 kHz



AD 8066/W8
8" High Fidelity Woofer
$22.00 ea

Power Handling Capacity:
40 W rms
Impedance: 8 OHMS
Resonance Frequency: 28 Hz
Frequency Range: 35 Hz – 1.8 kHz



AD12100/W8
12" High Fidelity Woofer
$59.00 ea

Power Handling Capacity:
40 W rms
Impedance: 8 OHMS
Resonance Frequency: 19 Hz
Frequency Range: 40 Hz – 1.2 kHz

ADF500/4500/8 CROSSOVER NETWORK: $50.00 Pair
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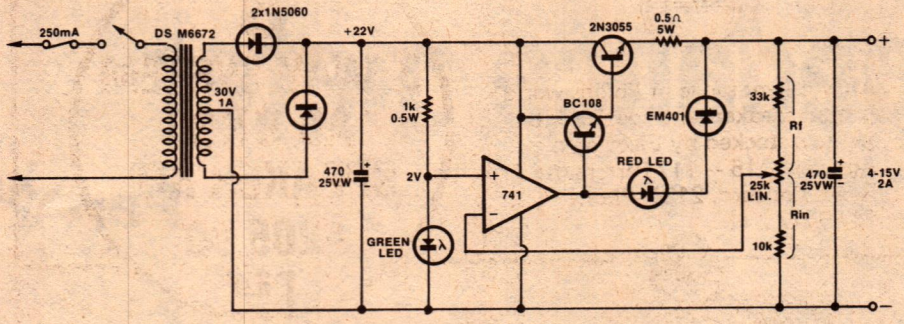


which also serves as a "power on" indicator light. With the resistance values shown the output voltage can be varied from 4V to 15V. Vo = Vref (1 + Rf/Rin).

The 0.5 ohm resistor, the EM401 diode and the red LED form a current limiting circuit which limits the maximum current to 2A, with low resistance loads or short circuits. The red LED lights when current limiting occurs, allowing it to be used as a fault indicating light. With the 2N3055 mounted on a 5cm length of Philips type 35 heat sink it can withstand a short circuit on the output indefinitely.

(By Mr M. J. Lauritsen, 7 Nicolle Avenue, Hawthorndene, Sth Aust. 5051.)

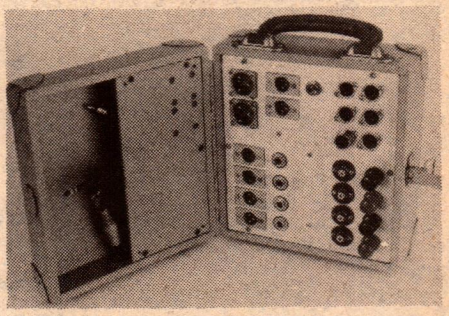
Handy patch panel in a box

Here is a handy little unit I have evolved to solve interconnection problems. As an entertainer, I work with a variety of audio and lighting equipment of my own, which frequently has to be interconnected with in-house audio and lighting systems at various venues. Needless to say, Murphy's Law always seems to operate, so that the plugs and sockets don't mate.

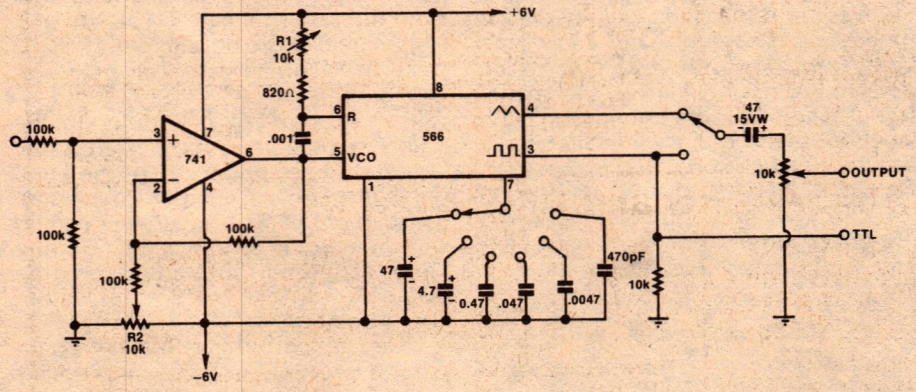
To solve the problem I made up the patching box shown. It simply provides a variety of audio and other connectors, interconnected in groups. Inside the lid I carry a number of patching cords, which may be used to interconnect between the groups to provide even more permutations and combinations. Between the cords and the interconnected sockets, this provides a solution to just about every patching problem I have met.

Just which sockets you provide is up to you, of course, and you can also make the box in any convenient form. But I pass on the basic idea, as it should be of value to anyone who must set up audio and similar equipment in a variety of situations.

(By Mr. M. Ronell, 14 Griffen Street, Surry Hills NSW 2010)



FM square & triangular wave generator



A useful signal generator that can provide both square and triangular waveforms is shown in the circuit. It can be made to oscillate over a wide range of frequencies. The device will operate from 0.5Hz to 500kHz with the values of components illustrated.

The maximum output voltage of the square waveform is approximately 6Vp-p into a load greater than 2K and approximately 2.2Vp-p for a triangular waveform. R1 provides a 10 to 1 frequency variation while the selector switch S1 selects the frequency range by switching different values of capacitance into the circuit.

The 741 operational amplifier not only acts as a buffer stage to the input but also provides the correct DC level to the input of the VCO. This DC level is adjusted with the potentiometer R2. It should be set at approximately 4V to obtain minimum FM distortion.

The maximum VCO input voltage is ±0.5V and the corresponding frequency deviation is ±3.3kHz. The frequency of the modulating signal may extend from DC to about 100kHz which is adequate for most applications.

(By Mr T. G. Tang, PO Box 26, St Lucia, Qld 4067.)

Winner of the EA-Parameters project competition

Audio impedance meter

Part 2

Last month, we detailed the performance characteristics of this new audio impedance meter, and described the circuit. In this second article we present the constructional details, and describe how the completed instrument is used.

by RONALD SALTER
12 Ayr St, Macleod, 3085.

The only part of the circuit left to describe is the power supply, which consists of two type 216 9V batteries, and double-pole switch S4. The writer originally intended the power supply to be 9 volts total, so that a package supply could be used, but there was insufficient AC drive to the coupling transformer at this voltage. The drain from each battery is close to 8mA so, unless the unit is left switched on for long periods, the batteries will last a good while. Rechargeable cells in this size are now available if you are prepared to pay the price.

The instrument is built in a 196 x 112 x 60mm plastic box with aluminium panel, and both are easy to drill, ream, or file. A Scotchcal panel can be made from the panel drawing (Fig. 5a). The components, aside from panel controls, meter, batteries terminals and three resistors, are mounted on a 55mm x 155mm PCB. Fibreglass is the preferred material for this board since insulation resistance, particularly around the inputs to ICs 3 and 4, should be as high as possible.

The PCB is attached on the front panel with two angle brackets and the board mounting has been arranged to keep the leads from S2 to the multiplier resistors to a minimum length. The angle brackets are in turn attached to the front panel by machine screws, one of which must be countersunk to clear the potentiometer knob. Put a solder lug under one of these brackets, and run a wire to the PCB earth strip, to earth the front panel. The measuring terminals are mounted in the left-hand end of the box, in line with the front panel marks, on ¾in centres to accommodate a 2-pin banana plug.

The oscillator frequency switch, and input jack for the signal generator, are mounted in the right-hand end of the box. This allows the oscillator to be deleted without altering the panel layout. The prototype employed Dymo labels for the frequency selection, but a Scotchcal label could be made from Fig. 5b.

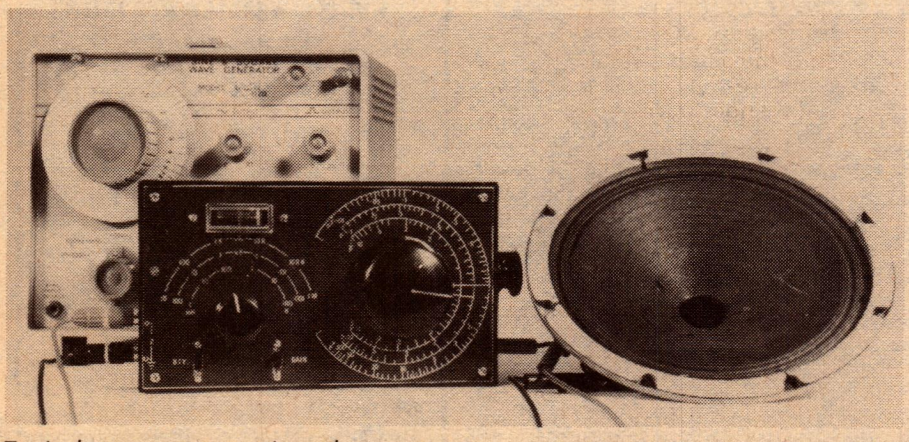
If the gain potentiometer option is preferred, simply drill a hole for the pot. shaft, using the centre of the gain switch cutout as the drilling point. The panel lettering is arranged to allow the lettering "HI" and "LO" to be obscured by the pot. knob. Because of the gain control options, resistors R15, R16 and R17 are not on the PCB; they are mounted on a small lug strip, which is secured to the front panel by slipping the strip mounting lug under the switch mounting flange, and putting the switch screw through both.

For the gain pot., the only resistor to be accommodated is R17, and this can be soldered between the pot. lug and the pot. case, care being taken to ensure that the case is earthed to the front panel. If in doubt, run an earth wire from the case to the PCB. The batteries can be held in the bottom of the plastic case by a small bracket made of aluminium strip.

In an effort to be a little different, the ratio dial pointer is made from a pin, fastened to the underside of the knob skirt with contact cement. Make sure the shaft of the pin is accurately aligned with the white pointer line on the knob. If desired the pointer could be made from a scrap of perspex with a line scribed on it.

Take care with the assembly of ratio pot. P4, because the accuracy of the instrument depends on it. The dial pointer must align accurately with the end stop marks on the dials, and the pot. shaft must be absolutely concentric with the dial scale. Check this by noting whether the tip of the pointer remains concentric with the scale as the knob is rotated. Take care also with the wiring from the PCB to the various switches.

The leads from S2 to the multiplier resistors R7 to R12, the trimpot P6, and the trimmer C12, must be kept as short as possible. It is also desirable that the leads to the switch S1 be kept short, although trouble will be experienced in fitting S1 into the case if these leads are



Typical test set-up using the new instrument. Here the impedance of a loudspeaker is being measured at various frequencies provided by an audio oscillator.

cut to the bare minimum. An average length of 50 to 70mm seems a reasonable compromise.

The lead from the PCB to the hot side of the test terminals should also be kept as short as possible. The writer first wired this in shielded cable, but found that the cable capacitance affected the calibration severely at high frequencies. Use small-diameter hookup wire for this lead.

Coming now to the calibration and use of the meter, the first step is to set the oscillator gain pot. This is best done using an oscilloscope. With S1 set to F1, put the probe on the output of IC1, and adjust P1 until oscillation just occurs, with little or no visible distortion. Switch to F2, and again check the waveform. If an oscilloscope is not available, simply turn on the meter with the Z terminals open circuit, and set P1 on minimum gain. (Pot. moving contact at earth end.) Slowly increase P1 until the meter deflects suddenly to one side. Check that the meter deflects on both F1 and F2. If not, increase the setting of P1 a little.

Next, set the buffer amplifier gain. Put a resistor across the Z terminals, and roughly balance the meter. With the oscilloscope probe on the hot Z terminal, adjust P2 for maximum output without visible clipping of the waveform. Without an oscilloscope, put a resistor across the Z terminals, and adjust the controls until the meter is nearly, but not quite, balanced. Now adjust P2 for minimum meter deflection, then slowly increase it again while watching the meter. A point will be reached at which the meter deflection will remain constant despite increases in P2. Set P2 just below this point.

If the oscillator has been omitted, a slightly different procedure is required. Adjust P2 for minimum gain (minimum meter deflection or oscilloscope signal), then slowly advance the signal generator output control, until waveform clipping occurs or meter deflection ceases. Back the output off a little and note the output control setting. This will be the maximum permissible level, and will give the most linear calibration, although voltages less than this can be used.

Now for the ratio dial calibration. You will need three close-tolerance resistors with values of 100 ohms, 10 kilohms, and 1 megohm. Put the 100 ohm resistor across the Z terminals and set Rm to the 1 kilohm position. Set the ratio dial to 0.1 on the P scale and adjust P5 to null the meter. (If the null occurs at the other end of the scale, reverse the end connections to P4, then repeat the adjustment.) Now put the 10 kilohm resistor across the terminals, turn the dial to 10.0, and adjust P3 to null the meter. This may upset the 100 ohm adjustment a little, so repeat these steps several times.

All that remains is calibration of the 1 megohm range, which is best done using a signal generator. Before beginning the calibration, the signal generator output voltage must be set as described above. With the 1 megohm resistor across the Z terminals, adjust the signal generator to 100Hz, switch to the 1 megohm range and set the ratio dial to 1. Adjust P6 until the meter nulls. Set the signal generator to 10kHz and adjust C12 to null the meter again. If the meter will not null, reduce the frequency to 5kHz and re-adjust C12. If a signal generator is unavailable, set P6 in the F1 position and C12 in the F2 position. Your Meter is now calibrated.

RESISTANCE MEASUREMENT: Simply place the unknown resistor across the Z terminals, and adjust the multiplier switch and ratio pot. dial until the meter nulls. Read the value from the resistance scale on the multiplier, and the P scale on the pot.

Example:

The multiplier switch is set to 1 kilohm. The ratio dial reads 0.3 on the P scale. The resistance value is 1 kilohm x 0.3 = 300 ohms.

Either F1 or F2 may be used, or any signal generator frequency from 10Hz to 10kHz. For extreme high and low resistance, consult calibration charts.

IMPEDANCE MEASUREMENT: Place the unknown impedance across Z, and adjust the dial for balance, using the ohms scale and P scale as above. Use a signal generator if the impedance at a particular frequency is desired.

INDUCTANCE MEASUREMENT: The 2-frequency measurement of inductance is, with a little practice, easier to do than to describe. Follow these steps:

a. Turn the oscillator switch to F2, or adjust the signal generator to 1590Hz.

b. Adjust the dials for a null setting, and read the value on the P^2 scale.

c. Turn the oscillator switch to F1, or adjust the signal generator to 159Hz.

d. Again null the meter, and read the value of P^2. If it is necessary to change the multiplier switch to obtain the second null, repeat steps (a) to (d), using the next higher or lower position of Rm, as required.

e. Subtract the reading obtained in (d) from the reading obtained in (b). Turn the knob to this value on the P^2 scale.

f. Read the value under the pointer on the P scale.

g. Multiply this number by the inductance reading on the multiplier scale.

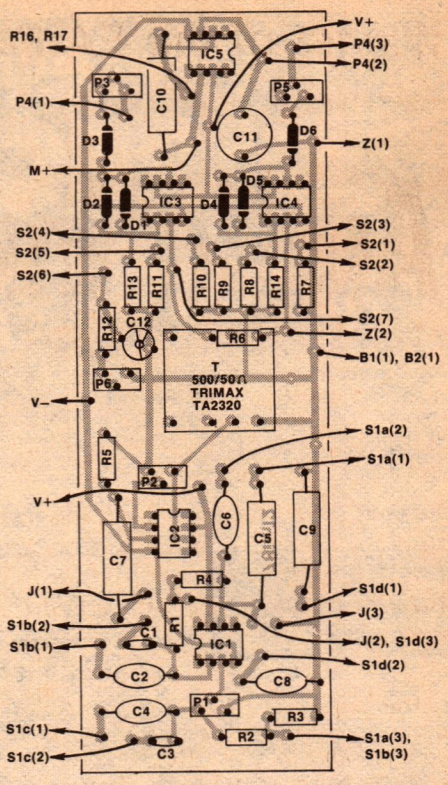
Example:

Reading at F2 — The multiplier switch is set to 10 henries. The ratio dial reads 6 on the P^2 scale.

Reading at F1 — The multiplier switch is set to 10 henries. The ratio dial reads 2 on the P^2 scale.

Subtract 2 from 6: 6 - 2 = 4.

Turn the dial to P^2 = 4.



Layout of components on the PC board. Note that resistor R6 is soldered directly across the transformer terminals.

Read the corresponding point on the P scale. P = 2. Therefore the value of the inductance is 10 henries x 2 = 20 henries.

CAPACITANCE MEASUREMENTS: For capacitors with negligible leakage, which is the usual case, follow these steps:

a. Turn the oscillator to F1, or adjust the signal generator to 159Hz.

b. Adjust the dials for a null setting, and read the value on the 1/P scale.

c. Then the value of the capacitor can be read from the capacitance scale on the multiplier, and the 1/P scale on the pot.

Example:

The multiplier switch is set to 10 uF.

The ratio dial reads 0.2 on the 1/P scale.

The capacitance or value is 10uF x 0.2 = 2uF.

If leakage is suspected, repeat (a) and (b) above, reading the value on the P^2 scale. Then proceed as follows:—

d. Turn to F2, or set the signal generator to 1590Hz.

e. Null the meter, and again read the value of P^2.

f. Subtract the second reading from the first, and set the dial to the resultant, on the P^2 scale.

g. Read the value under the pointer on the 1/P scale, and multiply it by the capacitance reading on Rm.

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SPECIFICATIONS	:	for P.A. Systems
CIRCUIT	:	8—transistor OTL circuit
OUTPUT POWER	:	10 Watt maximum, per channel
OUTPUT IMP.	:	8 ohms
FREQUENCY RESPONSE	:	20—25:000Hz
INPUT IMP	:	100K ohms
POWER SOURCE	:	DC 24V. 800mA

1 lb

$11.50

All silicon 4-transistor OTL circuit

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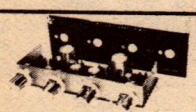
FREQUENCY RESPONSE	:	40 - 40,000Hz
GAIN	:	120mV input for non-distorted max. output
INPUT IMPEDANCE	:	About 50KΩ
OUTPUT IMPEDANCE	:	4 - 16Ω
POWER SOURCE	:	D.C. 24V - 30V
CURRENT CONSUMPTION	:	50mA at no signal, 500mA for max. output



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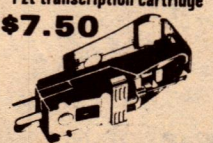

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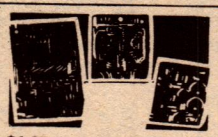

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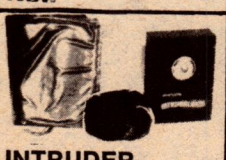

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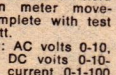
Specifications: AC volts 0-10, 50-250, 1000, DC volts 0-10-250-1000. DC current 0-1-100 DC Mr OHMS 0-150 K (3000 OHMS CENTRE. 8 oz.

Multi-Speed MAINS MOTOR



240v AC. **$5.95**

Exceptionally robust, brush-type, series wound motor

Six speeds: 500, 850, 1,100, 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) main drive shaft. Very powerful and useful motor. Size approx. 2 1/2" dia. meter, 5" long. 2 lb.

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1/3 h.p. cont. duty ball bearing construction. Beautifully made. Brand new. Ideal polishers, etc. 10lb.

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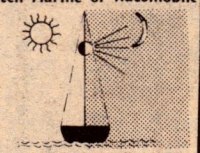
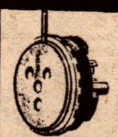


This new device will AUTOMATICALLY switch on your Riding or Parking lights at DUSK and switch them off again at DAWN. Complete instructions with all units. Panel or Dashboard size 4" x 13". Brand new, Price $5.95 Post 60c

12 volt D.C.



Brand New. **$5.95**

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LINEAR ACTUATOR Plessey Type

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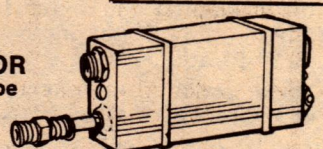

A compact aircraft actuator, in a rectangular case, with split series field motor having an operating voltage range 18-29 Volts DC, and a normal current consumption of 3 amps. Working load 100 lb. normal, 150 lb. maximum. Stroke 3 in. Operating time 6-7 secs. Rating of motor under normal load 1.5 mins.; output 0.03 h.p. at 12,000 r.p.m. The actuator includes snap-action limit switches, and a clutch to prevent damage in the event of overload. The plunger is fitted with a spring-loaded connector drilled two holes 3/16 in. diam. x 3/16 in. deep, and the rear end fitting is drilled 3/16 in. diam. x 5/8 in. wide. Distance between retracted centres 1, ½ in. A breeze plug is provided for electrical connections. Overall dimensions; 7, 38 in. x 3 in. x 2 in. Weight 2 lb. 3 oz. As new, in excellent working order. Cost Gov. $280. Also available in 6" stroke.

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12 in. sq. x 1 mm. thick. f.l. 13, 1/2 in.

Precision worked in thin optical plastic and providing large area magnification equivalent to expensive glass lenses. Fine optical quality permits use as solar furnace elements, condensers, image magnifiers, light intensifiers, overhead and back projection optics, camera image brighteners (disco scenes). Use our low RPM geared motors to drive these. 8oz.

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500 to 10,000 RPM fully ball bearing, controlled by speed control.

Special 3" pulley EXTRA. $5.75 Speed control EXTRA $45.00 These are one of the latest ENGLISH developments in 240v AC motors have tremendous applications in workshops, coil winding machines, pumps, drills, lathes, test machinery etc. 1,000's of other uses. The speed control is the latest electronic type completely enclosed with fine adjustment of RPM. Motor can be supplied with instructions for making you own speed control. $45. 12lb.

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Silent operation with overload clutch 240v A.C. Cont. duty. 8 RPM 6oz.

"Meccano" Power Units $9.50

Type 8156. Beautifully made in England by this famous manufacturer. 240 volt A.C. mains input gives 26 volts at .63 amp. and 26 volts at .63 amp. output. Complete with two adjustable accelerators (resistors), each with approx. 3ft. of cord, that control output voltage. Housed in metal case. Brand new in carton with instructions. 6ft. lead and plug. Original cost $26. 8lb.

12 VOLT POWER UNITS, $7.50

Made in England by "Smoothflow", a division of "Meccano". 240 volt A.C. input, 12 volt D.C. output at .6 amp. Fully protected from damage by automatic cutout which resets itself automatically. Brand new in cartons with instructions. Ideal models, battery charger for small batteries (especially our Nife Batteries). Terrific bargain!

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Brand new 240 V. A.C. 50 C.P.S. 10 v/a Veeder Root Counters. Has reset wheel to zero unit. A 1001 applications in repetitive function monitoring. **$10.50** 12 oz.

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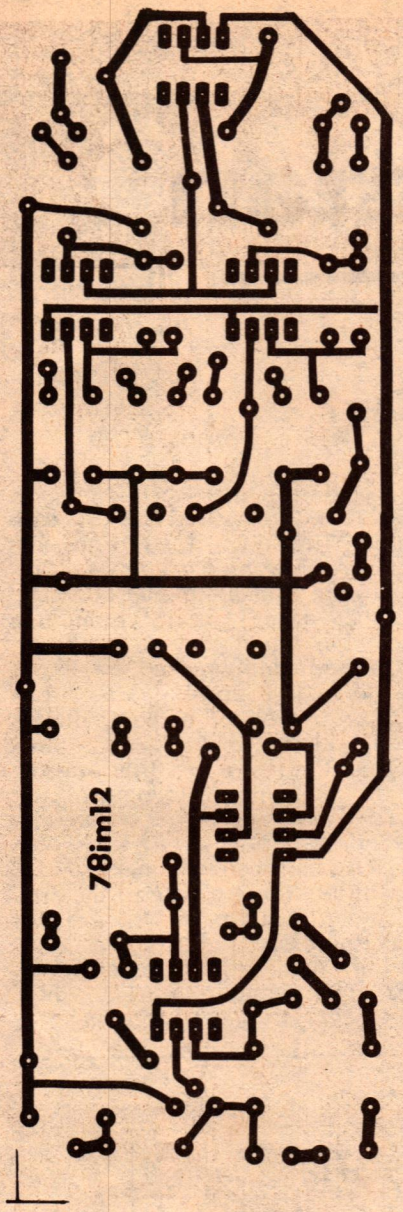


Actual size reproductions of the PC pattern and the front and side panels.

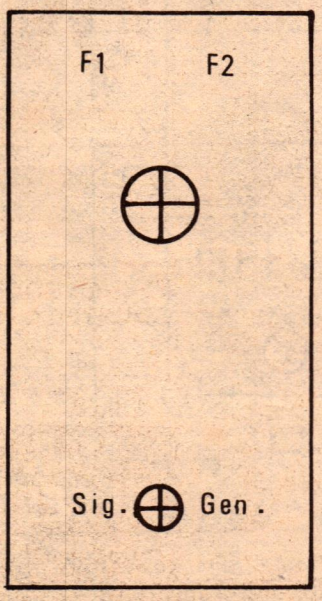


FIG. 5b

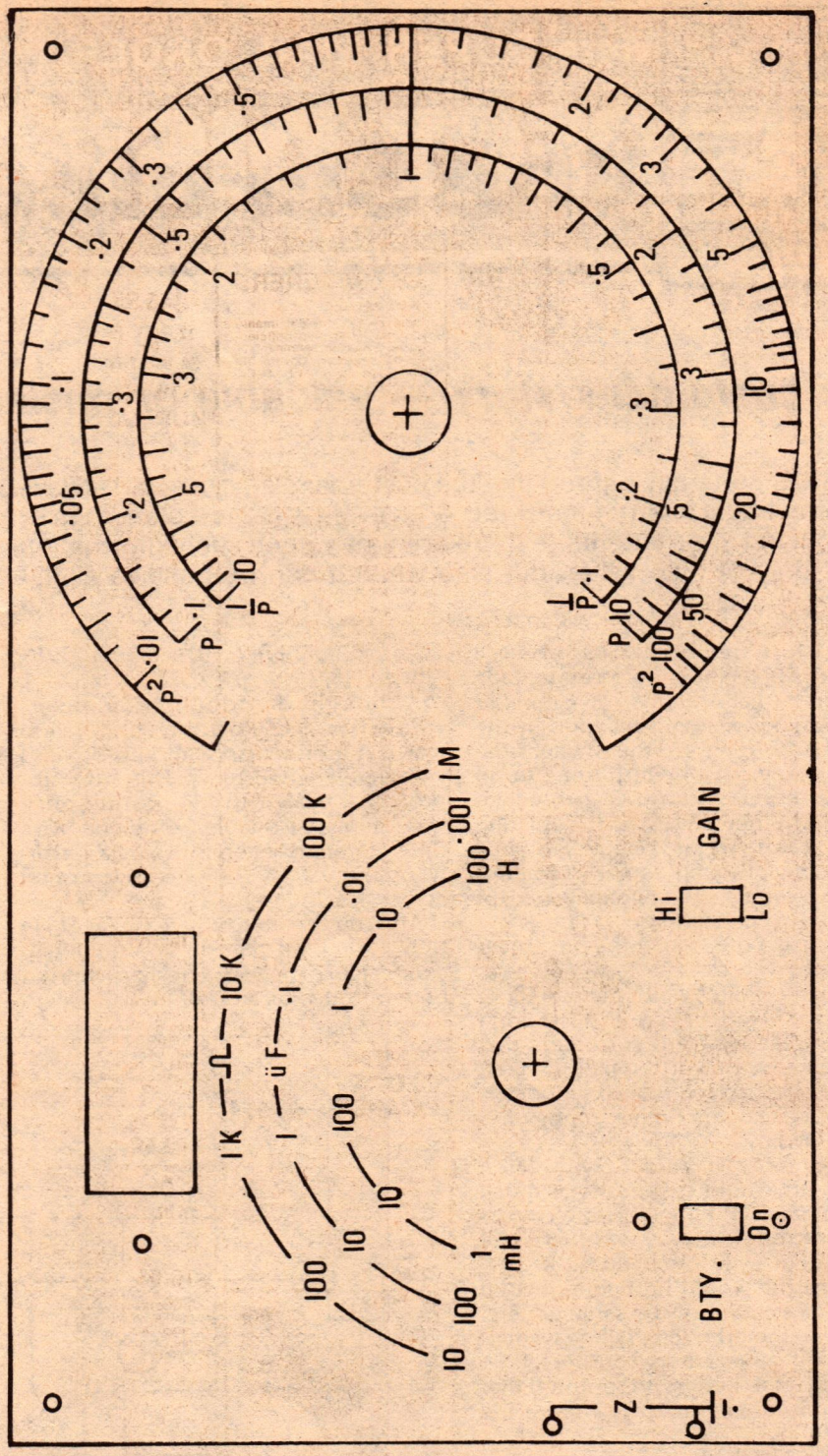


FIG. 5a

Example:—
Reading at F1 — The multiplier is set to 0.1uF. The ratio dial reads 1.0 on the P^2 scale.
Reading at F2 — The multiplier is set to 0.1uF. The ratio dial reads 0.2 on the P^2 scale.
Subtract 0.2 from 1.0: 1—0.2 = 0.8.
Turn the dial to P^2 = 0.8.
The corresponding point on the 1/P scale is 1.1.
Then the value of the capacitor is 0.1uF x 1.1 = 0.11uF.

RESONANT FREQUENCY MEASUREMENT: Using the signal generator, adjust its frequency to give the highest impedance reading for a parallel L-C tuned circuit, or the lowest impedance for a series L-C tuned circuit.

References

1 "Measurement of Iron-cored Inductances", Radiotron Designers Handbook, 4th Edition, P. 250.
2 "Easy-to-Build R-L-C Bridge", Electronics Australia, P. 40, Vol. 39 No. 12 March 1978.
3 Unpublished contribution for "Circuit and Design Ideas", titled "Improved R-C Oscillator", from the writer, to Electronics Australia.

The Serviceman

The customer's story — valuable or misleading?

While it is generally agreed that the customer's story should always be taken into account on any job — to avoid misunderstandings or overlooking intermittents — there are times when such information is not only of little value, but also when it can be positively misleading.

This story really started when a customer brought in a cassette tape deck and small commercial amplifier which, by now, was a bit long in the tooth. According to the owner, the whole system had been playing up in several respects and he wanted to known whether it was worth repairing or whether he should scrap it, and buy a new one; probably something better than the simple "radiogram" concept which this represented.

I duly gave the system the once-over and, while the cassette tape deck was performing quite well, the amplifier system was in a bad way. While I don't normally like advising customers that equipment is not worth repairing, I felt that this was a case where I honestly could not recommend any money being spent on it.

For a number of reasons I considered that repairs would cost nearly as much as the original amplifier (it wasn't a particularly expensive one) and that, if he was content with this standard of performance, he would be better advised to buy a new unit of the same general kind. One the other hand, if he wanted something better — as I suspected — he would be better off putting that amount of money towards a more expensive unit.

He accepted my advice, said he would think about it, and that was the last I saw of him for several weeks. When he next appeared he had what looked like a brand new amplifier tucked under his arm and an expression which suggested that he had lost $10 and picked up five cents!

I was right (well almost) on both counts. It was a brand new amplifier and, while he hadn't actually lost any money, he was feeling pretty despondent. It seemed that he had decided to invest in a better quality amplifier and, after seeing one demonstrated at a friend's home had been most impressed by the Playmaster Twin 40 amplifier. (December 1976, January 1977.)

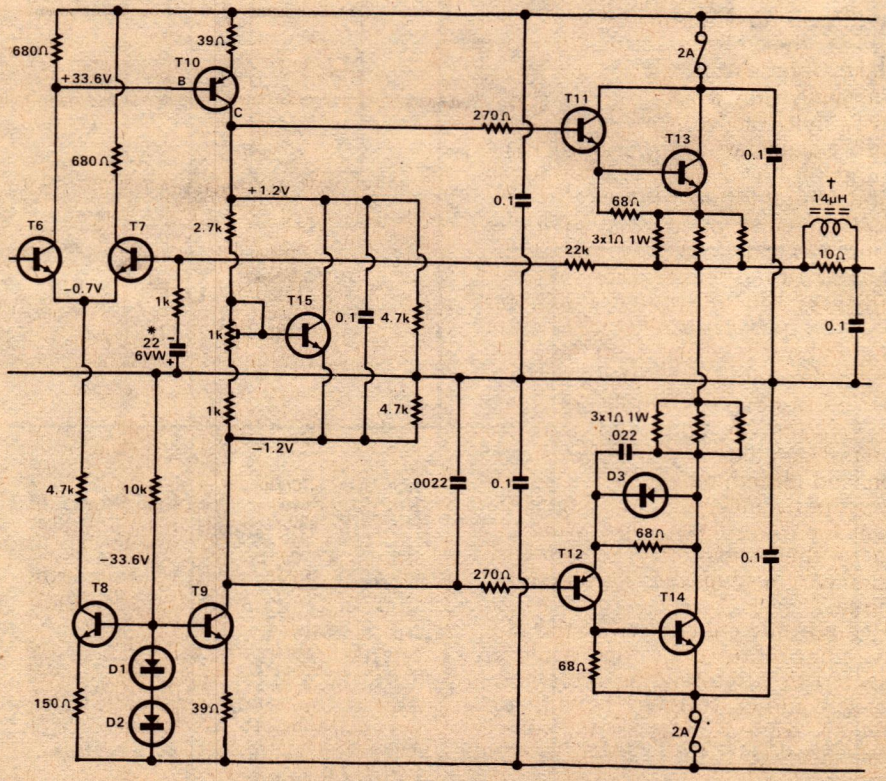
Although described as a do-it-yourself project he had found a firm which not only marketed kits, but also completely wired units. This latter approach appealed to him, as the price was quite reasonable compared with other commercial units of similar quality. So this was the unit he now pushed across the counter.

And the reason for the long face? He freely admitted that, in an attempt to connect his speakers, he had shorted both outputs. As a result he had blown all four fuses; one each from the positive and negative rails of each channel. This much was obvious, but what he really wanted to know was how much more damage he had done.

At that stage I wasn't committing myself, but I told him he would be lucky if he hadn't wrecked the output transistors and, possibly, the driver transistors as well. All he could do was leave it with me to check out.

One of the first things I did was dig out the appropriate copies of the magazine and study the circuit, the relevant portion of which is shown here. It is a fairly conventional system in line with the present state of the art.

In the unit itself, one of the first things I noticed was what appeared to be a burn mark on the case of one of the 2N3055 output transistors; which didn't seem to augur too well for



The section of the circuit involved in this story. A quite ridiculous voltage across the speaker terminals was finally traced to an equally silly reading on the collector of T8. From here, a process of elimination revealed the fault.

finding the system intact.

My first step was to go over the output and driver transistors with an ohmmeter and, allowing for the fact that they were in circuit, try to determine if there were any obvious base-emitter or base collector breakdowns. Rather surprisingly, I could find none.

Thus encouraged I fitted new fuses and prepared to apply power, taking the precaution of not connecting any speakers at this stage. When I finally pressed the switch, half expecting to produce smoke, fire, and confusion, it was a complete let down. All the fuses remained intact and there were no fireworks of any kind.

I went over the circuit with a voltmeter, with particular attention to the base-emitter voltages of the output transistors, then the driver transistors, and then the earlier stages. As far as I could determine everything was normal.

The next logical step was to connect a speaker and feed a tone into the system and see what happened. Having only one speaker which was convenient to use I connected it first to the left hand channel, connected the audio generator and, lo and behold, out came a nice clean signal from the speaker. As far as I could determine, short of an actual power output test, this half was behaving normally.

I moved the speaker over to the right hand channel and tried again. This time it was a different story; the fuse from the -35V rail promptly disintegrated. I disconnected the speaker, replaced the fuse, and switched on again, knowing that this set-up was quite stable. Then I checked the voltage across the open speaker terminals.

Normally one would expect to find only a few millivolts between these points but in fact it turned out to be around 18V! Well, at least I had finally found something to work on.

Not knowing quite what might be wrong I decided to play safe. I disconnected the speaker, then removed both fuses and substituted a 100 ohm resistor in both cases. That way I could work without fear that something else was on the point of breaking down.

To be honest, the whole thing had me puzzled. It appeared that the shorted speaker connections had damaged something which was causing a gross unbalance in the output circuit. By far the most likely culprit would be one of the transistors, yet, from my preliminary testing, they all seemed to be intact.

I could only conclude that the fault was rather more subtle than could be detected by a multimeter, remembering that direct coupled circuits can produce some quite drastic effects from, seemingly, small defects in early stages.

The logical conclusion was that each transistor should be tested, which meant removing each one from the

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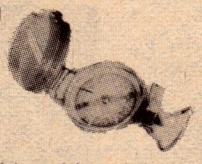

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WITH HANDSET ANTENNA $25 EA.
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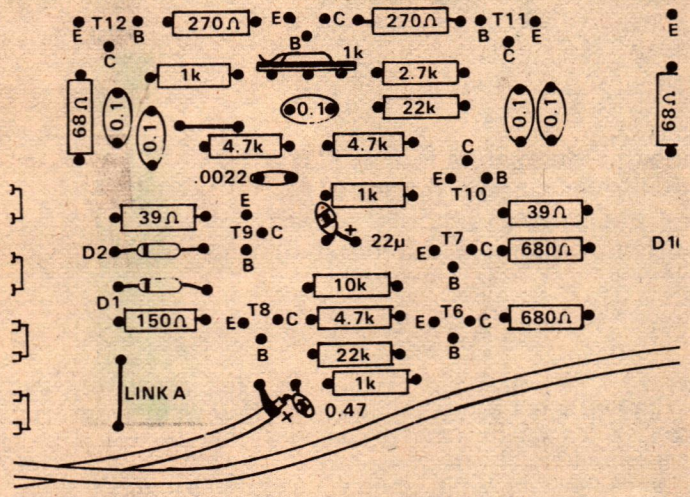
board. Fortunately, the layout was reasonably open and this would not present any real problem. Having made that decision, I decided that the best way to test each transistor was simply to replace it with a new one. A quick check confirmed that I had all the types on hand, and such a check is by far the best one.

(This is not to say that I have anything against transistor testers. It is just that, in sticky situations like this one, a replacement test inspires more confidence. Nor is it any greater effort; they have to come out anyway.)



The area of the board where the trouble occurred. On the right is a 39 ohm resistor with two 680 ohm resistors below it. On the left is a 39 ohm resistor with a 150 ohm resistor below it. 'Nuff said!

So, stage by stage, I replaced each transistor, making appropriate voltage checks after each change. Alas, no joy. After I replaced all the transistors the symptoms were exactly the same as before. All that I had established was that it was not a faulty transistor.

But if not a transistor, then what was it? What kind of a fault could have been caused by the speaker short, other than a damaged transistor?

At this point I decided to put the thing to one side. For one thing, I felt that a break from it might allow more rational thinking when I came back to it. For another, there were more urgent jobs which I just had to finish. Nevertheless, every time I looked over to the corner of the bench where the monster sat, I attempted to rationalise the problem.

By the time I came back to the job I decided that I would do what, I suppose, I should have done earlier; make a very careful voltage check of every stage and at least try to rationalise each reading. Some voltages were shown on the circuit, while the very comprehensive setting up and trouble shooting instructions in the January issue provided additional voltage references.

The first few readings provided little in the way of clues, but I became suspicious when I checked T8, and particularly the collector voltage. This was about 4V but, having skimmed through the trouble shooting instructions, I recalled a reference to T8 and a quite different voltage. Sure enough, when I found the reference, it suggested -22V; a much more reasonable figure when one studies the circuit.

There were only a few components associated with this transistor; the 4.7k collector resistor, the 10k resistor from base to the 0V rail, the 150 ohm resistor in the emitter circuit, and the two diodes D1 and D2 from base to the -35V rail. I had already checked the diodes, so that really left the three resistors as the main suspects.

The 4.7k and the 10k measured out correctly, but I realised that I had found something when I checked the 150 ohm. It was reading over 600 ohms and a closer look showed why — it was, in fact, a 680 ohm resistor.

I put down the test prods and, I'm afraid, said some very naughty words; words which reflected on the immediate ancestory of whoever had assembled the amplifier.

When I felt a little calmer I realised how easy it would be to make such a mistake. There are two 680 ohm resistors in the nearby circuitry and, in fact, their position on the printed board is quite close to that of the 150 ohm resistor. Fair enough, but what about the bloke who tested the amplifier? Or was it ever tested?

We shall probably never know, but I mentally transferred my wrath to whoever it was who should have tested it, but didn't!

Mind you, I'd been well and truly caught. The customer's red herring about the shorted speaker connections had sent me off on a wild goose chase. (Sorry about that mixture!) But, seriously, the story is a classic example of how the customer's story can be a hindrance rather than a help.

Fortunately, such situations are rare and it would be unwise to offer them as a reason for disregarding the customer's story, or failing to encourage it if it is not offered. It is something we just have to accept on the rare occasions that it happens.

How to use the Matsushita modules:

Add a low cost printer to your 2650

Here are the details of how to interface the Matsushita model EUY-10E023LE printer and its companion driver board, model EUY-PUD024C to your microprocessor. Details of a suitable power supply are also provided, as well as driver routines to suit the 2650 microprocessor.

by DAVID EDWARDS

Obtaining hard copy has always been one of the major bugbears of the home computerist. Secondhand ASCII teleprinters are available, but can cost several times the price of the rest of the system put together. (If you can afford a new teleprinter, you needn't read any further!)

Baudot teleprinters are available at quite reasonable cost, but require a code conversion from ASCII to Baudot, which as well as being messy, tends to raise the overall package price quite markedly. So when Philips (the local agents for Matsushita printers) supplied us with details of the new printer, we at once decided that this would be a boon for the home hobbyist.

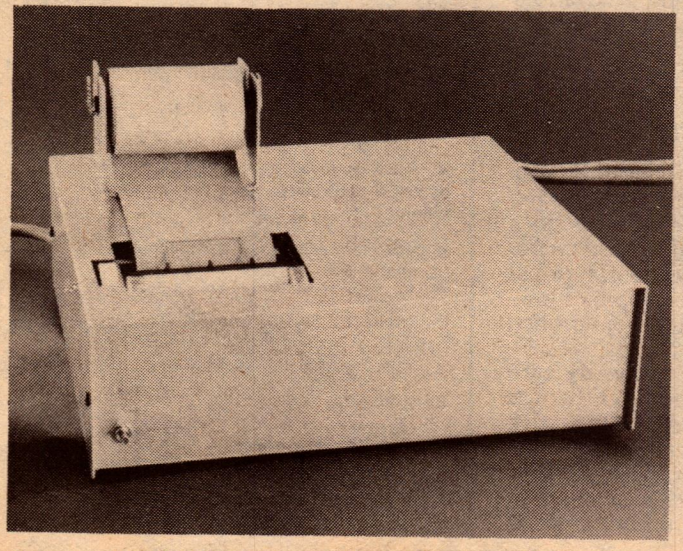
Approximate price of the printer unit and the interface board is $200.00 plus tax if applicable. Power supply requirements are quite modest, and could possibly be met from existing supplies, or from junk box (or redundant, if you want to be nice!) components.

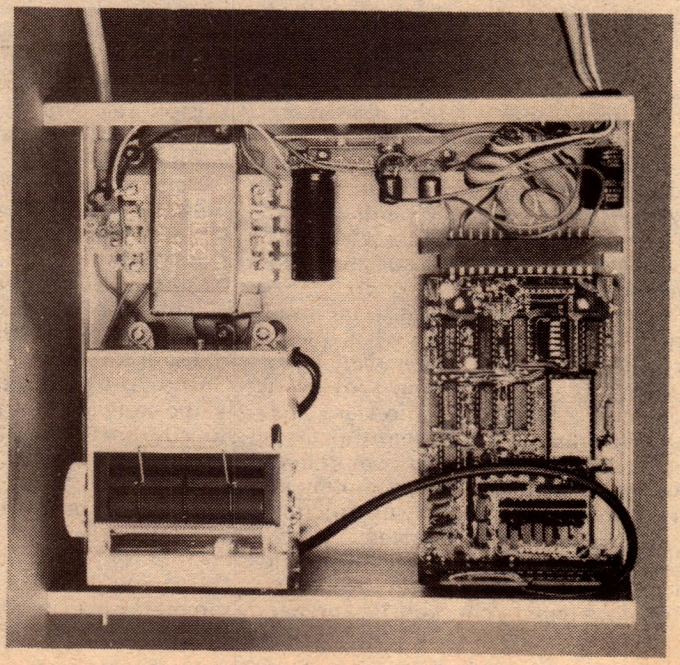
The units are supplied with comprehensive instruction manuals, giving full details on both mechanical and electrical interfaces, as well as flowcharts and programs suitable for use with the Motorola 6800 "D2" evaluation kit.

Overall size of the printing unit is 110 x 90.5 x 39.5mm. Printing is on electrosensitive paper 60mm wide, utilising a travelling head containing seven electrodes. The head scans from left to right, and can print 32 characters on each line. Approximately two lines can be printed each second.

Characters are formed from a 7 x 5

These two photographs show the printer module and interface board assembled in a small aluminium case, along with the power supply components. Note the paper roll holder mounted on the lid of the case.





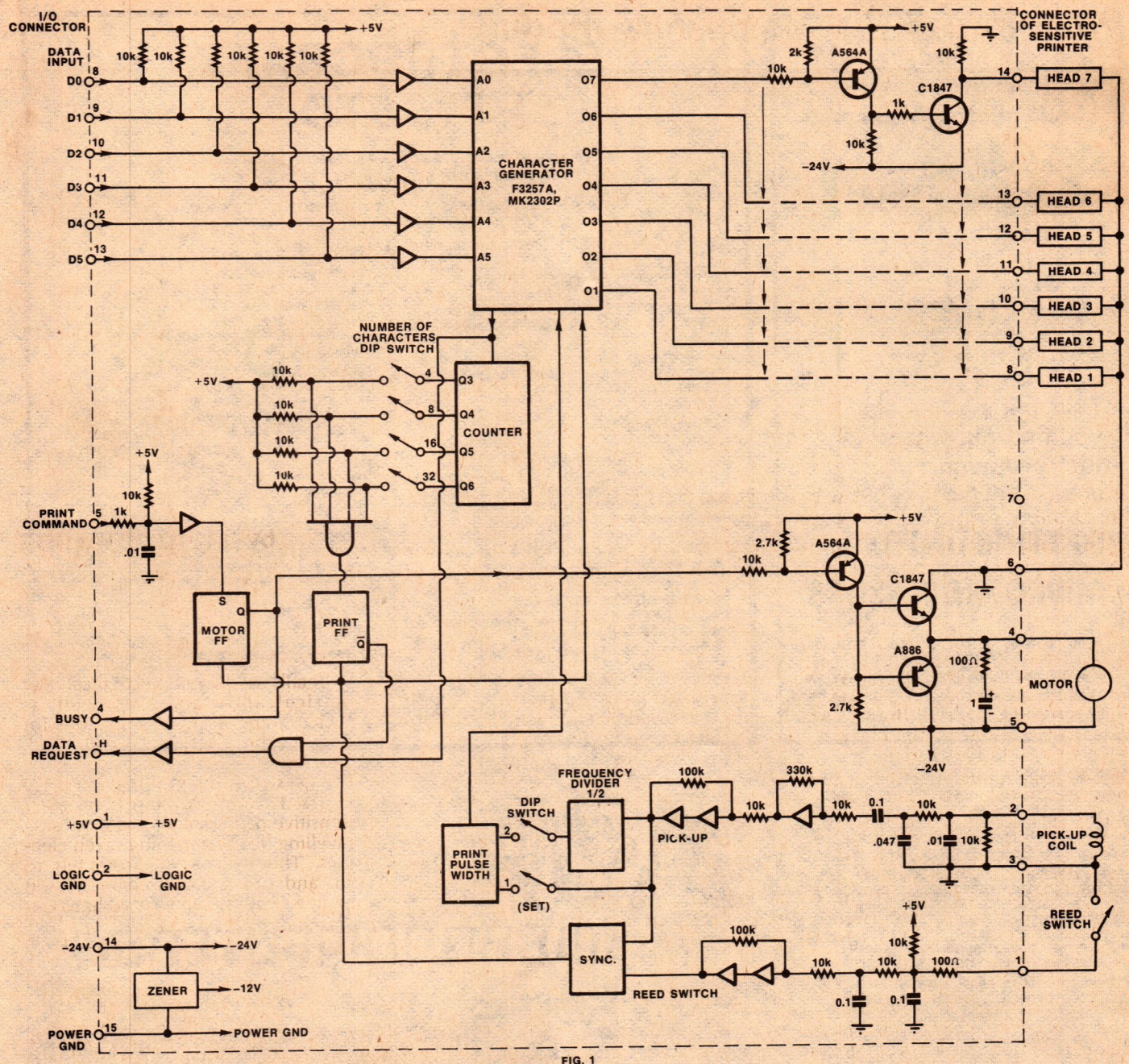


FIG. 1

Here is the schematic diagram of the interface board, which is used to generate the head drive signals from the computer outputs.

dot matrix, and are approximately 2.4mm high. Lines are spaced 2mm apart. The dots are formed by passing current pulses from the appropriate electrodes to the aluminised paper. This burns off the top layer of the paper, leaving a black dot.

Head movement is achieved with the aid of a 24V DC motor. A cam and switch synchronised to the head provide pulses to strobe the characters in time, thus ensuring even character spacing, even if the motor speed varies.

The motor unit does not contain any electronics, and is provided with two cables to connect to the interface board. This board (Fig. 1) contains an I/O circuit, an input data processing circuit, a timing circuit and a character generator ROM. Data is input in the form of a six bit parallel ASCII code, and converted to the appropriate dot format by the character generator.

A DIP switch is provided to select either 16 or 32 characters per line; normally this would be set at the 32 character position. Three control signal lines are provided, but only two are necessary for a simple interface.

The PRINT signal is used to initiate printing. When this signal is received from the CPU on the interface board, the printing motor is started, and the head starts to scan across the paper. Once the first character has been printed, the DATA REQ signal is pulsed, to signify to the CPU that a second character is required. This sequence is repeated until the complete line has been printed.

The third control signal is BUSY, which is used to tell the CPU that the printer is occupied in printing a line. Provided the CPU waits for an adequate time after the last character has been sent to the printer, it is not necessary to use this signal.

Two power supplies are required for the interface board: +5V at 50mA and —24V at 200mA. The printer derives its supply voltages from the interface board. Fig. 2 shows a simple supply which is suitable, using two three-terminal regulators and a readily available transformer.

The printer is connected to the CPU via an 8-bit I/O port. For 2650-based

Adding a printer to your 2650 system

systems, this would normally be the D port. The connections we used, based on the I/O port diagram published in the November 1978 article on expanding the 2650 Minicomputer, are shown in Fig. 3.

Connections to other processor systems will be broadly similar in concept. The BUSY signal, if required, is available at pin 4 of the edge connector.

Needless to say, one needs suitable driver routines in the computer so that it can communicate properly with the printer via the interface. For the benefit of those with 2650 systems I have written some utility routines to do this. One is a basic printer driver subroutine, while the other two are a hex memory dump routine and a message printing routine. Both of these call the basic subroutine for the actual printing.

Fig. 4 shows a flow chart of the main subroutine, PRINT. This treats a portion of memory as a 32 byte buffer, and transfers the ASCII characters stored in it to the printer with the appropriate timing. It will detect a null character in the buffer, and then fill the remainder of the line with spaces. This gives the effect of a carriage return.

To print a number of lines, it is necessary to call the routine the appropriate number of times, changing the buffer contents between calls. To achieve the effect of a blank line, place a null character (X'00) in the first buffer location.

Fig. 5 is a disassembler listing of the PRINT subroutine in 2650 machine code. It occupies locations X'1400 to X'143E inclusive, and requires a 32 byte area of RAM to be set aside as the buffer. At present this occupies

```
145F 51
1460 51
1461 51
1462 51
1463 45 0F        ANDI,R1
1465 0D 62 59     LODA,R1
1468 CF 34 3E     STRA,R3
146B 17
146C 77 02
146E 3F 02 DB     BSTA,UN
1471 3F 00 A4     BSTA,UN
1474 3B F9        BSTR,UN    146F
1476 CD 04 0F     STRA,R1
1479 CE 04 10     STRA,R2
147C 07 00        LODI,R3
147E 09 94        LODR,R1    1514
1480 3B 5D        BSTR,UN    145F
1482 09 90        LODR,R1    1514
1484 3B 5D        BSTR,UN    1463
1486 0D 04 0E     LODA,R1
1489 3B 54        BSTR,UN    145F
148B 09 FA        LODR,R1    1487
148D 3B 54        BSTR,UN    1463
148F 04 20        LODI,R0
1491 3B 55        BSTR,UN    1468
1493 0D 84 0D     LODA,R1
1496 3B 47        BSTR,UN    145F
1498 0D 84 0D     LODA,R1
149B 3B 46        BSTR,UN    1463
149D 08 E8        LODR,R0    1487
149F E8 D9        COMR,R0    147A
14A1 98 0E        BCFR,EQ    14B1
14A3 08 F4        LODR,R0    1499
14A5 E8 D0        COMR,R0    1477
14A7 98 08        BCFR,EQ    14B1
14A9 20           EORZ,R0
14AA 3B 96        BSTR,UN    1542
14AC 3F 14 00     BSTA,UN
14AF 9B 22        BCFR,UN    14D3
14B1 09 E6        LODR,R1    1499
14B3 0A D2        LODR,R2    1487
14B5 DA 02        BIRR,R2    14B9
14B7 D9 00        BIRR,R1    14B9
14B9 3F 00 A4     BSTA,UN
14BC 46 07        ANDI,R2
14BE 98 4F        BCFR,EQ    148F
14C0 20           EORZ,R0
14C1 3F 14 68     BSTA,UN
14C4 3B E7        BSTR,UN    14AD
14C6 1F 14 7C     BCTA,UN
```

FIG. 6

```
1400 77 10 07 00 F3 04 2A F8
1408 7E 07 40 F3 07 00 06 00
1410 02 98 18 0F 34 3E 18 19
1418 64 40 F0 04 C7 C0 F8 7D
1420 E7 20 18 11 70 F4 80 98
1428 7B 1B 65 DB 00 04 20 1B
1430 67 06 FF 1B 78 20 05 20
1438 F8 7E F9 7C 75 10 17 31
1440 34 34 30 20 33 34 20 33
1448 34 20 33 33 20 33 33 20
1450 32 30 20 33 33 20 33 33
1458 20 33 33 00 47 4F 4F 51
1460 51 51 51 45 0F 0D 62 59
1468 CF 34 3E 17 77 02 3F 02
1470 DB 3F 00 A4 3B F9 CD 04
1478 0F CE 04 10 07 00 09 94
1480 3B 5D 09 90 3B 5D 0D 04
1488 0E 3B 54 09 FA 3B 54 04
1490 20 3B 55 0D 84 0D 3B 47
1498 0D 84 0D 3B 46 08 E8 E8
14A0 D9 98 0E 08 F4 E8 D0 98
14A8 08 20 3B 96 3F 14 00 9B
14B0 22 09 E6 0A D2 DA 02 D9
14B8 00 3F 00 A4 46 07 98 4F
14C0 20 3F 14 68 3B E7 1F 14
14C8 7C 77 02 3F 00 A4 07 00
14D0 0C 84 0D CF 34 3E 18 14
14D8 09 F7 0E 04 0E DA 02 D9
14E0 00 3B E9 E7 20 98 69 3F
14E8 14 00 1B 62 3B FA 17
```

FIG. 8

To the left is a listing of the hex listing routine. This was used to produce the listing above of all the programs presented in this article, on the new printer. It is reproduced actual size.

```
14C9 77 02
14CB 3F 00 A4     BSTA,UN
14CE 07 00        LODI,R3
14D0 0C 84 0D     LODA,R0
14D3 CF 34 3E     STRA,R3
14D6 18 14        BCTR,EQ    14EC
14D8 09 F7        LODR,R1    14D1
14DA 0E 04 0E     LODA,R2
14DD DA 02        BIRR,R2    14E1
14DF D9 00        BIRR,R1    14E1
14E1 3B E9        BSTR,UN    14CC
14E3 E7 20        COMI,R3
14E5 98 69        BCFR,EQ    14D0
14E7 3F 14 00     BSTA,UN
14EA 1B 62        BCTR,UN    14CE
14EC 3B FA        BSTR,UN    14E8
14EE 17
```

FIG. 7

Shown above is a dissassembler listing of the message printing routine, while below is a flow chart of the print routine, which is used to control the printer.

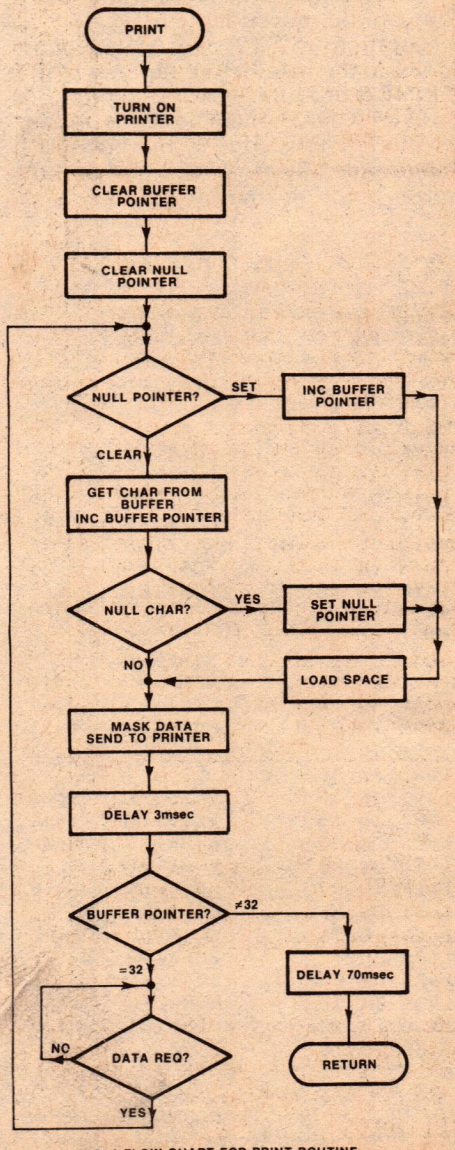


FIG. 4 FLOW CHART FOR PRINT ROUTINE

Adding a printer to your 2650 system

locations X'143F to X'145E inclusive.

The PRINT subroutine is relocatable. To change the starting address of the buffer, which must be in the same page as the subroutine, put the address of the byte before the desired starting address into locations X'1414 and X'1415. Note that bits 6 and 7 of location X'1414 must remain as zeroes, while bit 5 must remain a 1.

Fig. 6 is a disassembler listing of the listing program, which will print out a listing of a specified area of memory. As the print format is only 32 characters wide, it prints only the line starting address and eight bytes per line. To call the program, type G 146C XXXX YYYY cr, where XXXX and YYYY are the start and end respectively of the required memory block.

The program occupies locations X'145F to X'14C8 inclusive. It uses Pipbug routines GNUM, STRT, ANSI and PIPBUG. It contains absolute addresses, but can be moved fairly easily.

Locations X'1469 and X'146A must point to the byte before the start of the PRINT subroutine's buffer memory.

Bytes X'14AD and X'14AE must point to the starting address of the PRINT subroutine. Bytes X'14C2 and X'14C3 must point to the new location of current location X'1468, and bytes X'14C7 and X'14C8 must point to the new location of current location X'147C.

Fig. 7 is a disassembler listing of a message printing subroutine. This expects R1 and R2 to contain the starting address of an ASCII message. This message is printed when the subroutine is called. The end of the message is signified by a null character. Messages can be stored anywhere in available memory, provided they are in the same page as the message program.

The message subroutine is relocatable, and uses the Pipbug routine STRT. Locations X'14D4 and X'14D5 must point to the byte before the first byte of the PRINT buffer, and locations X'14E8 and X'14E9 must point to the PRINT routine itself.

Fig. 8 is a hex listing of all three routines, produced by the hex listing program on the new printer itself. It is reproduced actual size, so you can see directly the size and quality of the printing.

Further details on the model EUY-10E023LE printer and companion interface board (model EUY-PUD024C) can be obtained from the local agents, ELCOMA, of 67 Mars Road, Lane Cove, NSW 2066.

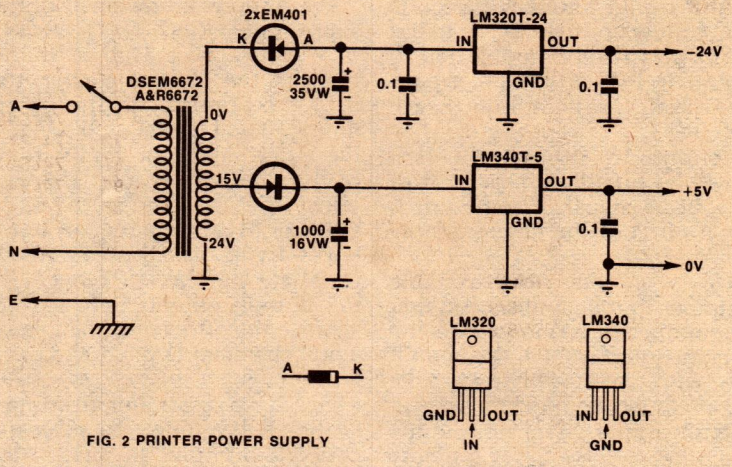


FIG. 2 PRINTER POWER SUPPLY

The connection diagram for the 2650 Mini Computer is shown below. We used the "D" output port.

Shown above is the circuit diagram of the suggested power supply. It uses a readily available transformer.

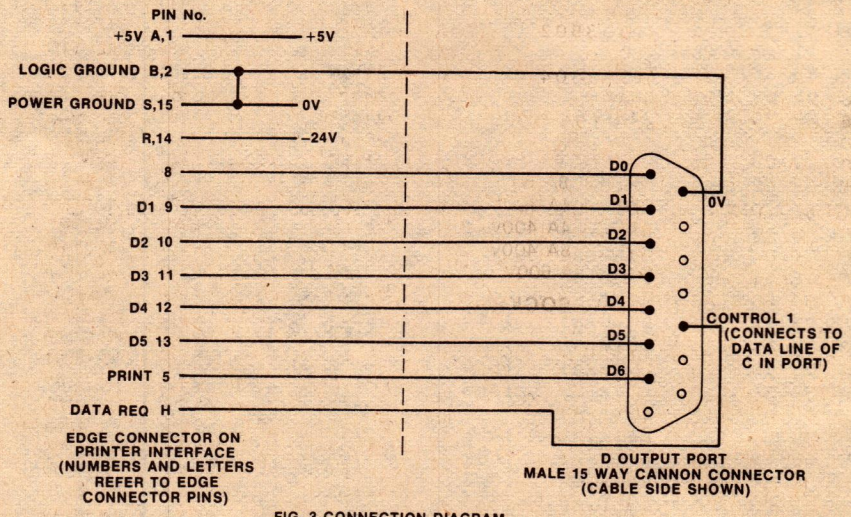


FIG. 3 CONNECTION DIAGRAM

```
1400 77 10
1402 07 00          LODI,R3
1404 F3
1405 04 2A          LODI,R0
1407 F8 7E          BDRR,R0     1407
1409 07 40          LODI,R3
140B F3
140C 07 00          LODI,R3
140E 06 00          LODI,R2
1410 02             LODZ,R2
1411 98 18          BCFR,EQ     142B
1413 0F 34 3E       LODA,R3
1416 18 19          BCTR,EQ     1431
1418 64 40          IORI,R0
141A F0
141B 04 C7          LODI,R0
141D C0             STRZ,R0
141E F8 7D          BDRR,R0     141D
1420 E7 20          COMI,R3
1422 18 11          BCTR,EQ     1435
1424 70
1425 F4 80
1427 98 7B          BCFR,EQ     1424
1429 1B 65          BCTR,UN     1410
142B DB 00          BIRR,R3     142D
142D 04 20          LODI,R0
142F 1B 67          BCTR,UN     1418
1431 06 FF          LODI,R2
1433 1B 78          BCTR,UN     142D
1435 20             EORZ,R0
1436 05 20          LODI,R1
1438 F8 7E          BDRR,R0     1438
143A F9 7C          BDRR,R1     1438
143C 75 10
143E 17
```

FIG. 5

The hex listing reproduced above is for the routine used to control the printer. It is written as a subroutine.

ROD IRVING ELECTRONICS

LINEARS

301	.40
307	.65
308	1.25
309K	1.90
311	.80
317K	2.90
318	3.25
324	1.25
325	4.60
339	.85
348	1.60
349	2.25
356	1.65
377	2.75
379S	6.95
380 14 Pin	1.30
381	1.95
382	1.95
387	1.90
386	1.90
555	.35
556	.85
565	1.90
566	2.40
567	2.60
709	.70
723 (VR)	.50
741	.30
747	.90
3900	.85
3909	1.20
CA3028	2.90
CA3046	2.10
CA3130	1.95
CA3140	1.95
RL4136	2.90

REGULATORS

7805	1.00
7806	1.20
7808	1.20
7812	1.00
7815	1.20
7818	1.20
7824	1.20
7905	1.50
7906	1.50
7908	1.50
7924	1.50
7912	1.50
7915	1.50
78L05	.40
78L12	.40
78HGKC	8.50
78H05	7.90
78H12	7.90
723	.50
309K	1.90
317K	2.90

OPTO

FND357 C.C.	1.30
FND500 C.C.	1.25
FND507 C.A.	1.40
FND800 C.C.	3.50
TIL209 Leds	.20
RED LEDS	.18
100 for	13.00
YELLOW	.30
GREEN	.30
Mounting Clips	.3

DIODES

1N4148	.5
100 for	4.00
1N4002	.7
1N4003	.8
1N4004	.9
100 for	7.00
1N5625	.50

RESISTORS

1/2 Watt I.R.H. Metal Glaze 1 ohm to 1M (E24 Values). 1-99 3
100-999 ..... 2.5
(Mixed)

TRANSISTORS

BC547/8/9	.15
BC557/8/9	.20
BD139	.55
BD140	.55
2N3055	.85
MJ2955	.95
BC337	.25
BC338	.25
BF115	.85
BF180	.75
PN3643	.25
PN3645	.25

BRIDGES

MDA3501	35A
100V	4.10
MDA3502	35A
200V	4.20
MDA3504	35A
400V	4.50
W04 1.5A 400V	.80

SCR

C103YY .8A 60V	.80
C106A1 4A 100V	.95
C106D1 4A 400V	1.30
C122D1 8A 400V	2.50
C122E 8A 500V	2.60

I.C. SOCKETS

8 PIN	.25
14 PIN	.33
16 PIN	.35
18 PIN	.50
20 PIN	.60
22 PIN	.75
24 PIN	.80
28 PIN	.90
40 PIN	1.00

TTL

7400	.25
7401	.25
7402	.25
7403	.25
7404	.35
7405	.35
7406	.50
7407	.50
7408	.32
7409	.32
7410	.25
7411	.35
7413	.55
7414	.90
7416	.60
7417	.60
7420	.25
7421	.50
7422	.30
7426	.45
7417	.45
7430	.30
7432	.40
7437	.50
7438	.50
7440	.30
7441	1.50
7442	.70
7447	.95
7448	.95
7450	.35
7451	.35
7453	.35
7454	.30
7460	.35
7470	.65
7472	.45
7473	.60
7474	.65
7475	.65
7476	.45
7480	1.25
7483	1.25
7485	1.45
7486	.65
7489	1.90
7490	.50
7491	1.00
7492	.65
7493	.65
7494	1.10
7495	.95
74100	24.5
74107	.65
74121	.50
74123	.90
74132	1.25
74150	1.60
74151	1.10
74153	1.10
74154	1.70
74157	1.10
74160	1.55
74161	1.75
74164	1.55
74165	1.55
74173	2.75
74175	1.65
74180	1.35
74192	1.40
74193	1.40
74197	1.50
74221	1.50
74251	1.50
74367	1.20
74368	1.20

74LS

74LS00	.25
74LS01	.30
74LS02	.25
74LS03	.30
74LS04	.35
74LS05	.35
74LS08	.30
74LS09	.30
74LS10	.25
74LS11	.30
74LS12	.30
74LS14	1.00
74LS15	.35
74LS20	.30
74LS21	.30
74LS22	.35
74LS26	.40
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.30
74LS37	.45
74LS38	.45
74LS40	.30
74LS42	1.10
74LS47	1.40
74LS48	1.50
74LS49	1.80
74LS51	.45
74LS54	.45
74LS55	.45
74LS73	.90
74LS74	.50
74LS75	.70
74LS76	.95
74LS78	.50
74LS83	1.50
74LS85	1.50
74LS86	.50
74LS90	1.10
74LS92	1.20
74LS93	1.10
74LS95	1.50
74LS107	1.20
74LS109	.50
74LS112	1.20
74LS113	.55
74LS114	.55
74LS122	2.00
74LS123	1.90
74LS125	1.90
74LS126	1.50
74LS132	1.60
74LS126	.79
74LS138	1.20
74LS139	1.90
74LS151	1.20
74LS153	1.90
74LS154	1.60
74LS157	1.00
74LS158	1.90
74LS160	2.20
74LS161	2.20
74LS162	2.30
74LS163	1.20
74LS164	1.30
74LS168	3.30
74LS169	3.50
74LS170	3.50
74LS173	2.10
74LS174	1.00
74LS175	1.00
74LS190	2.80
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	1.20
74LS196	1.20
74LS197	1.90
74LS221	1.90
74LS253	1.85
74LS279	.65
74LS365	.75
74LS366	.90
74LS367	.75
74LS368	.75
74LS386	.95

CMOS

4000	.40
4001	.25
4002	.25
4006	1.40
4007	.25
4008	1.25
4010	1.25
4011	.25
4012	.25
4013	.55
4014	1.30
4015	1.20
4016	.50
4017	1.30
4018	1.40
4019	.75
4020	1.55
4021	1.35
4022	1.60
4023	.25
4024	.90
4025	.40
4026	2.10
4027	.80
4028	1.25
4029	1.85
4030	.40
4040	1.30
4041	1.25
4042	1.25
4043	1.59
4044	1.50
4046	1.80
4049	.60
4050	.60
4051	1.20
4052	1.20
4053	1.20
4060	2.60
4066	1.00
4068	.40
4069	.35
4070	.40
4071	.40
4072	.40
4073	.40
4074	.40
4076	1.85
4077	.40
4078	.40
4081	.40
4082	.40
4510	1.40
4511	1.40
4518	1.50
4519	.95
4520	1.45
4528	1.20
14553	7.30
14584	1.25
74C00	.40
74C02	.40
74C04	.40
74C08	.40
74C10	.40
74C14	1.75
74C48	2.40
74C73	1.20
74C75	1.20
74C76	1.35
74C90	2.20
74C93	2.20
74C175	1.85
74C192	2.20
74C193	2.20
74C221	2.20

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Calculator chart for hex displacements

Probably the biggest chore when you are programming a microcomputer in hexadecimal code is calculating relative address displacements. Here is an improved displacement lookup table which the author claims is easier and more rapidly used than any method yet published.

by COLIN KEAY

Associate Professor of Physics, The University of Newcastle NSW 2308

Unless you happen to be proficient at subtraction in hexadecimal arithmetic, the determination of relative address displacements is the most irksome task faced by microcomputer programmers who attempt to assemble programs manually. Even when using a microcomputer with a built-in displacement calculator routine the required button-pushing takes time, especially if you forget or mistake the addresses in memory where the origin and destination bytes must be lodged for processing. Furthermore each microcomputer with this facility has a different procedure to follow.

Alternatively, one may work from sequential hexadecimal number tables which require tedious counting, buy a Texas Instruments "Programmer" calculator or use a Relative Jump Ruler as described by John S. MacDougall (Interface Age, March 1978). This requires that the program be coded on a line-per-byte basis, which is a considerable nuisance for the majority of microcomputers.

There had to be a better way, and it was found by analogy with the unique way the old IBM 1620 computer performed its decimal arithmetic with binary coded numbers. This is the reverse problem: getting decimal-oriented humans to work in hexadecimal. The solution is a simple but universal look-up table for finding hexadecimal differences one digit at a time, with provision for borrowing when necessary between digits. The resulting Microcomputer Program Displacement Table shown in Fig. 1 has been used to assist the manual assembly of programs for a variety of different microprocessors and has proved very successful as a programming teaching aid.

Using the Displacement Table is almost self-explanatory. A few examples will make the procedure clear. First, a program branch back from A7 to 54 as demonstrated in Fig. 2. Take the low order digit first, descending column 7 to the row containing the destination digit 4 which also contains the digit D in the column under X1. Similarly, descend from A to 5 and in the same row as 5 the digit A is found in the column under X2. The required displacement byte is therefore AD.

Had the first destination digit been located within the dotted triangle the second digit of the displacement byte would have been obtained from the column under X1. This takes into account the absence of a "borrow" from the subtraction of the first digit. So for our second example consider a branch from A7 to 8D as shown in Fig. 3. Descending from 7 we find D is within the dotted triangle. In the row containing D we find the digit 6 under X1, but for the next digit we must this time find it again under X1 and not X2.

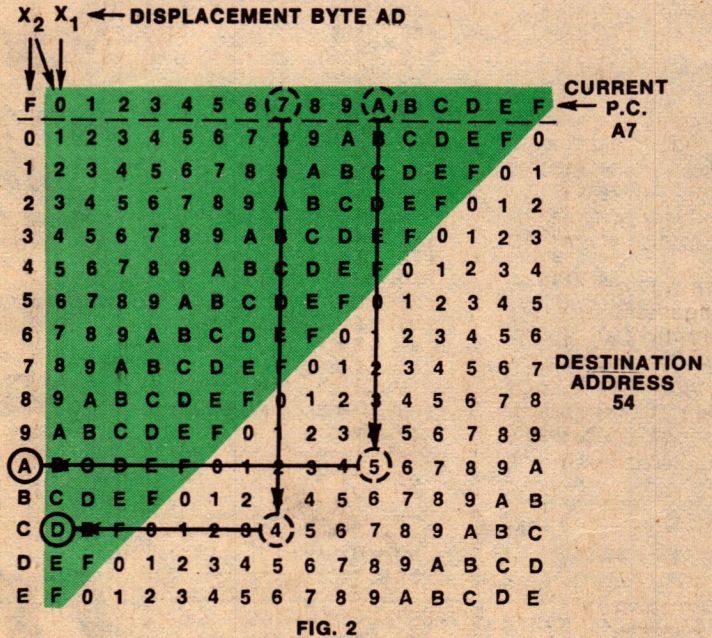


FIG. 2

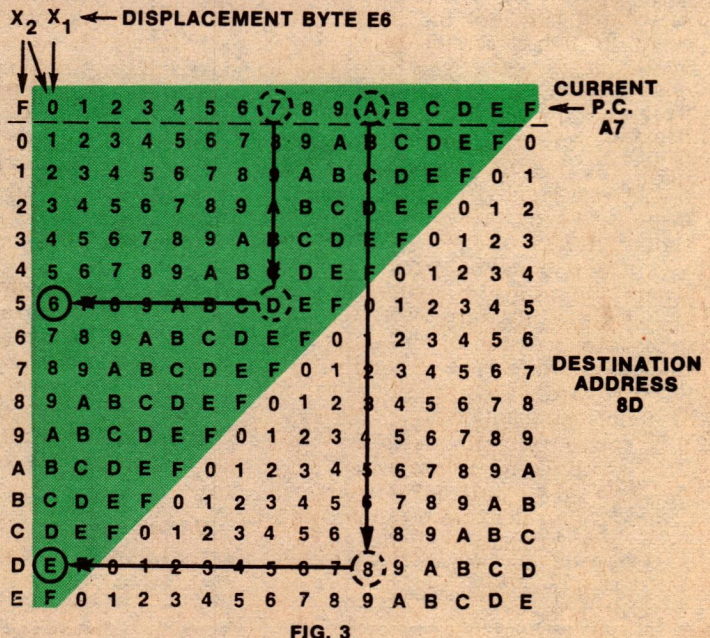
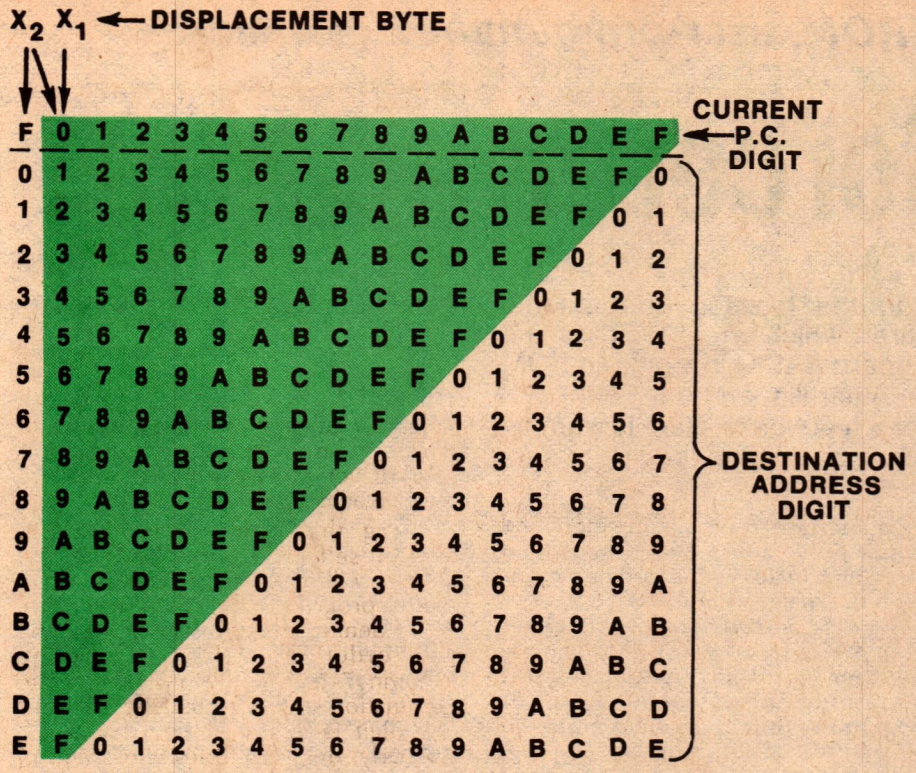


FIG. 3

These two examples show how the displacement table is used. The example in Fig. 2 shows a jump from A7 to 54, while that in Fig. 3 shows a jump from A7 to 8D.



F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0
1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1
2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2
3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3
4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4
5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5
6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6
7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7
8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8
9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A
B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B
C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C
D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D
E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E

RULE: IF FIRST DESTINATION IS WITHIN SHADED TRIANGLE X2 WILL BE ALSO

FIG. 1 MICROCOMPUTER PROGRAM DISPLACEMENT TABLE

Here is Professor Keay's table, inspired by the computational method used by an early computer. Using it you can find relative address and branch displacements very rapidly and conveniently.

Descending from A to 8 we find in the row containing 8 the digit E under X1. The required displacement byte is therefore E6.

We have assumed that the high-order byte is identical for the current address and the destination. Whenever the high order bytes differ, a single byte may be insufficient for the displacement. In such a case the Displacement Table can be employed to obtain X3 and X4 in exactly the same way as for X2. One must simply obey the rule that whenever a destination digit falls within the dotted triangle the subsequent displacement digit must also be within the dotted triangle. For this reason the dotted region of the table has been nicknamed "The Bermuda Triangle" — when landing in it one stays in it, but only for the next turn!

Besides calculating program displacements the table is useful for determining the length of program segments, subroutines, etc. For example, can a program extending from 27B9 to 3C63 be relocated in a gap between 0FA2 and 1455? Using the table we find that the program is 4AA bytes in length and the gap is found to be of 4B3 bytes, so it will fit with 4B3-4AA = 19 (hex) bytes to spare.

This technique uses hexadecimal numbers exclusively and thereby avoids the confusion inherent in the Address Calculator Tables (such as Ray Boaz's table in Byte Magazine, April 1978) and Multi-base Conversion Charts (wall-size or otherwise) where the actual arithmetic is performed in decimal notation.

Finally, when time permits, it is a good idea to check the results obtained using the Displacement Table by attempting to perform an actual hexadecimal subtraction and if necessary, counting digits, in hexadecimal to verify the result. After a few weeks (or months?) of practice the terrors of hexadecimal arithmetic will vanish and the Displacement Table can then be thrown away — even when calculating fearsome reverse jump displacements!

It offers 8K BASIC in ROM, user-programmed graphics:

Exidy's Sorcerer

One of the most recent entries in the blossoming personal computer market is the Exidy Sorcerer, which offers features like programmable graphics and 8K Standard BASIC in a plug-in ROM pack. Sorcerers are now available in Australia, and our Editor Jim Rowe has been able to try one out for a few weeks. Here is what he found:

I first came across the Exidy Sorcerer in April last year, when I visited the Percomp '78 hobby computer exhibition in Long Beach. It had just been announced, and the firm had an early prototype on their stand displaying graphics. It looked good, as I reported later in the magazine, although at that stage hardly anyone had even heard of Exidy — at least in the small computer field.

It turned out that Exidy Inc was a firm based in Sunnyvale, California, who had been making very successful coin-operated video arcade games for about five years. They had decided to use their microprocessor experience and branch into the personal computer area, and Sorcerer was the first of their new products.

In the months that have followed, the Sorcerer seems to have met with quite a warm reception in the USA. It has also started to appear "in disguise", under other brand names. So it was with some interest that I learned recently that Dick Smith Electronics had arranged with Exidy to market the Sorcerer in Australia, and that there would be an opportunity to try out one of the systems for myself.

A few weeks ago the sample Sorcerer arrived, and since then I have had quite a good chance to use it.

The Sorcerer itself is a single-board Z80 based microcomputer which is housed, along with its power supply, in a compact keyboard case. It is complete with inbuilt video interface, providing a video output suitable for either a standard video monitor or for connection via an RF modulator to a standard TV set.

The keyboard on the front of the unit has a total of 79 keys: 63 in a standard alphanumerical array and the remaining 16 in a numeric/graphics control pad. The main array offers both upper and lower case characters, together with provision for encoding up to 128 graphics codes.

Sorcerer has an inbuilt audio cassette interface, capable of working at either 300 or 1200 baud and with optional software control of up to two cassette deck motors. There is also an RS232 serial interface, 8-bit parallel input and output ports, and a 50-pin expansion port which mates with a forthcoming S-100 bus expansion unit.

The basic Sorcerer comes with either 8K or 16K bytes of user RAM memory, together with 4K bytes of ROM containing a powerful monitor program. With it also comes a plug-in "ROM-PAC" containing an 8K byte BASIC interpreter, written by Microsoft Inc. The ROM PAC is housed in what appears to be a converted 8-track tape cartridge moulding, and plugs into a slot in Sorcerer's right-hand end.

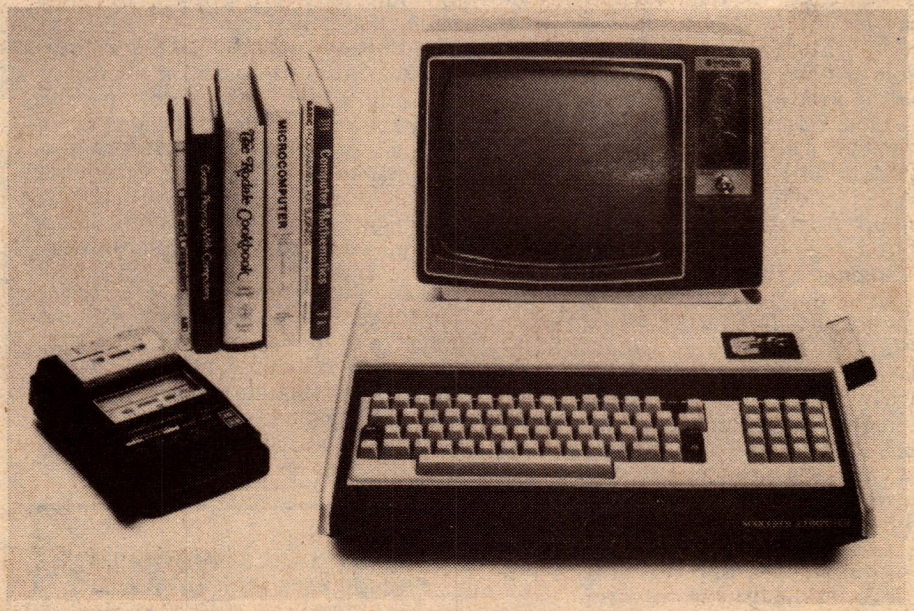
The idea of having the interpreter in a plug-in module is that you have greater flexibility; other software can be plugged in instead. In fact you can apparently already get cartridges with 8K of blank PROMs, to load with custom software. And Exidy itself is apparently about to release a second "Development System" ROM PAC, containing things like an assembler, a text editor, a debugging program and similar development aids.

The 4K monitor program which is permanently resident in Sorcerer has some powerful commands. When you dump programs onto a tape cassette, you give them a file name which can then be used by the load routine to seek and load a specified program from the cassette at a later stage. A file listing program can also be used to list all of the programs stored on a cassette.

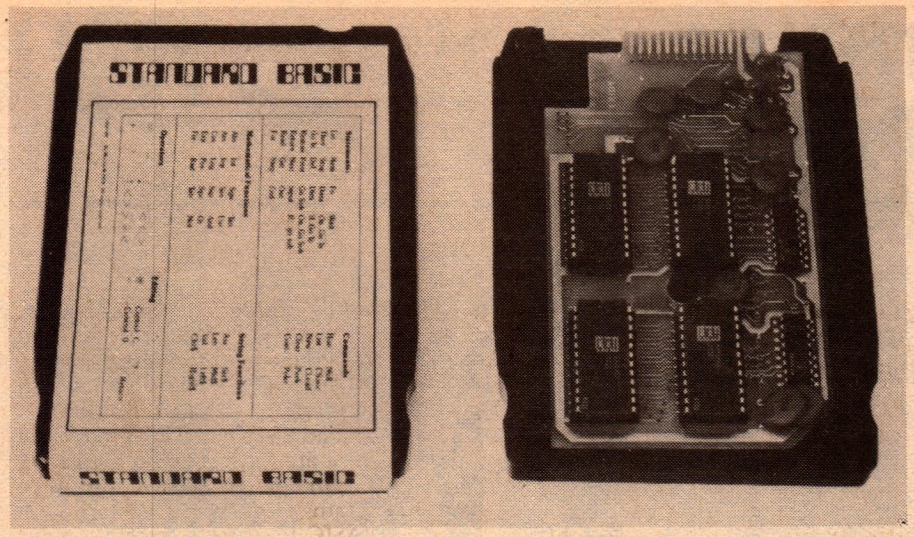
The BASIC interpreter which comes with Sorcerer is a full 8K standard BASIC. It allows named-program loading and dumping, a wide range of functions, 6-digit floating point arithmetic, and all normal BASIC commands. Other desirable features include PEEK and POKE statements, a USR command to link with machine language routines, string handling, and both numerical and string arrays.

And of course there are the graphics facilities. Sorcerer allows you to have up to 128 different graphics characters, any of which may be placed on the display screen in a 64 x 30 matrix. As the characters are themselves based on an 8 x 8 dot matrix, this gives an overall graphics resolution of 512 x 240 points.

All of the graphics character generation information is stored in RAM, and is potentially programmable by the user. However the monitor program normally creates the information for 64 "standard" graphics characters on power-up, and stores these away in half of the allocated 1K of memory space. The user can use these,



Here is the Sorcerer in a typical user situation, with the BASIC interpreter cartridge plugged in the side. The TV monitor, cassette recorder and books don't come with it for the price quoted — they're extra!



Outside and inside views of the plug-in ROM PAC, containing 8K BASIC.

together with another 64 custom-programmed characters, or can replace them if desired with a further 64 programmed characters.

Programming the graphics characters themselves is simply a matter of storing appropriate bit patterns in the right memory locations. Each character occupies eight consecutive memory locations, with the bits of each location corresponding to the eight graphics elements in each of the eight horizontal rows making up the character.

Two books come with the basic Sorcerer. One is a user manual, titled "A Guided Tour of Personal Computing"; the other is an introduction to BASIC programming called "A Short Tour of BASIC". Both are in ring binder form for ease of use, but I found them both rather disappointing in terms of content and organisation.

A significant proportion of the material in the user manual is little more than a repetition of material in the BASIC BOOK. At the same time, there is very little information on machine language programming, and none on such things as the significance of monitor error messages, and the use of monitor subroutines by user programs. To my mind this is almost essential information for any intelligent system user.

Similarly although both books describe the way the user can program graphics characters, neither devotes any space at all to explaining how the graphics are actually used in programming!

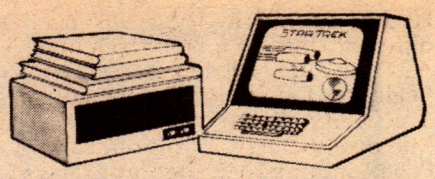
I understand that Dick Smith Electronics is going to remedy these shortcomings by providing some supplementary information.

The Sorcerer itself seems a well made unit. I did have a little trouble initially with faulty program reloading from cassettes, but this was apparently due to overload of the recorder's ALC circuitry during record. It was solved by fitting a small fixed attenuator in the recording lead. The recorder does not come with the Exidy; this probably explains the incompatibility.

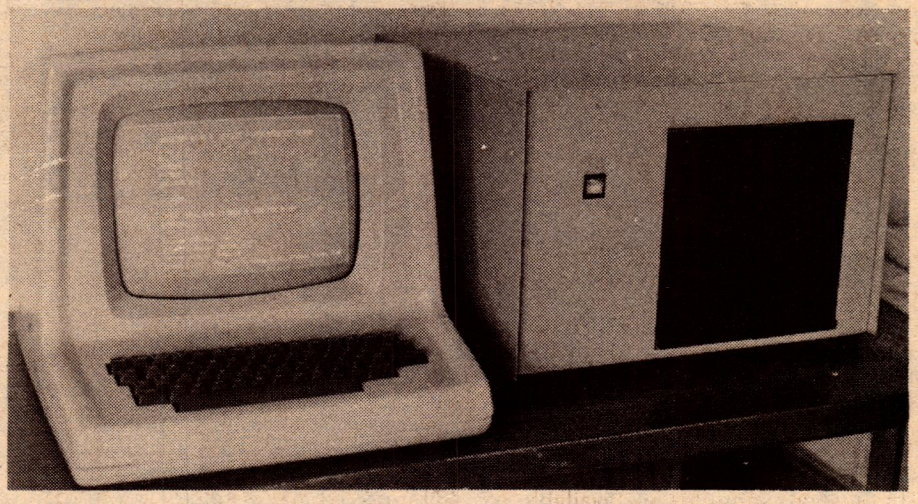
I found the Sorcerer quite easy to use. The BASIC interpreter is a good one, and provides all the commands one would normally require. The monitor is also powerful, although I would have liked to see at least one breakpoint facility.

Still, at $995 for the 8K version and $1250 for the 16K version, it seems very good value for money. You can see the Sorcerer at most DSE stores; it's well worth a closer look.

Microcomputer News & Products



Locally designed VDT, micro system



A new "glass teletype" video data terminal and a Z80-based microcomputer system — both locally designed and manufactured — have been released by General Electronic Developments Pty Ltd, of Gladesville, NSW. GED is a relatively new name in the digital field, having until recently been active mainly in the area of analog instrumentation, but their latest products demonstrate that they lack no expertise in the data processing area.

The model 135 teletype-replacement VDT features a 30cm black and white CRT with a 24 x 80 display format. The character set uses a 7 x 9 matrix, with descending lower case characters. The display is normally white letters on a black background, but black on white is available. Four cursor options are available: underline, blinking underline, reverse block and blinking reverse block. N-key rollover is standard, with three keyboard options.

The modem interface is RS232 or 20mA loop, while baud rates from 75 — 19,200 are standard. An unusual feature is a high speed option which will run at up to 153,600 baud.

The model 136 computer system is built into the same basic case as the terminal, and has a 16 x 64 terminal inbuilt. It is a Z80-based system, with provision for up to 48K of on-board RAM. Provision is also made for 8K or 16K of ROM for resident user software, with a ROM debug, disk bootstrap and CP/M disc operating system (2K) supplied as standard.

The system provides four full duplex serial ports which interface with either RS232 or 20mA terminals (i.e., model 135s). There are also four 8-bit parallel I/O ports, fully buffered and with handshake control lines, for printers, card readers, etc. The disk interface will accept up to eight IBM-compatible standard single density soft sectored 8-in floppy disks (it will also accept dual-sided drives). The standard system comes with two Shugart SA800 drives, as shown in the picture.

A built-in interface allows two cassette recorders to be connected for simultaneous read and write operation.

On the software side, languages available with the 136 system include Pascal, Fortran (ANSI), Cobol (ANSI), five different types of BASIC, a stack oriented language similar to FORTH, PILOT, and a string processing language similar to TRAC.

Utility software available includes the resident ROM debugger, symbolic debug utility, text editors, text editing language, text output processor, assemblers, macro pre-processor, macro assemblers, disk file utilities, disk format utility, disk analysis, dump and patch utilities.

Both the 135 VDT and the 136 computer employ GED's model 117 high performance video monitor module, which is also available to OEMs as a separate item. Using a 30cm tube, the monitor accepts composite video from a 75 ohm source, and is capable of a sharp 24 x 80 character display with very little geometric distortion.

Further information on all three products is available from General Electronic Developments Pty Ltd, 396 Victoria Road, Gladesville, NSW. Telephone (02) 816 2211.

Courses in Brisbane

The Brisbane Microcomputer Interest Group is planning to continue its series of 10-week educational courses this year, in conjunction with the Department of Technical and

Further Education. There will be five different courses in operation, titled 1. A Course in Digital Electronics; 2. Beginners Course in Microcomputers; 3. Advanced Course in Microcomputers; 4. Introduction to Programming Microcomputers; 5. Advanced Programming, Microcomputers.

Those interested in taking the courses should ring the T.A.F.E. office on either (04) 224-7847 or 224-7839 to reserve a place. Further information is available from Norman Wilson, Brisbane MIG, P.O. Box 81, Albion Qld 4010.

DC-DC converters

A series of very compact PCB-mounting DC-DC power converter modules is available from Instant Component Service. Made by ITT Components, the "Powermod" modules are suitable for microprocessor systems and any similar applications requiring high reliability, excellent regulation and thorough filtering.

The converters are available in two sizes, designated E and R respectively. The R series modules are available to suit input voltages of 5, 12, 24 and 48V, while the E series are available in two input voltage types: 5V and 12V. All modules have internal short-circuit protection.

Further information is available from ICS offices in all main states.

Classical Recordings

Reviewed by Julian Russell

Janacek — Katya Kabanova: unique

JANACEK — Katya Kabanova. Complete Opera. Elisabeth Soderstrom, Petr Dvorsky, Nadezda Kniplova with the Vienna Philharmonic Orchestra conducted by Charles Mackerras. Decca Stereo. Two boxed discs with brochure-libretto. D51D 2.

Despite the general excellence of the whole production, two artists dominate this recording — Elisabeth Soderstrom as Katya and conductor Charles Mackerras. Mackerras' years of study in Czechslovakia under that fine conductor Vaclav Talisch gave him an insight into not only the Czech character but especially into the music of Janacek. His admiration of the latter has persisted throughout his career, as has his continuing study of his works.

None of his performances that I have heard either live or recorded, fine as they were, approaches his superb account of Katya on these two discs. True he has all the advantages of the great Vienna Philharmonic as his orchestra, and also a Katya of rare sensibility and the keenest imaginable perception of the many sides of this complex character. It is a combination that is unlikely to be matched in the foreseeable future.

For those unacquainted with Janacek's music I had better explain that his style is unique. He has no forerunner of any consequence, and founded no school to successfully follow him. His peculiarly laconic — and sometimes ejaculatory style — was based for the most part on the rhythms and intonations of his native Moravian speech. It is way outside the general trend of central European music of his period, or any other period for that matter. Added to this he had a fine sense of melody that can ravish you with the intensity of its lyricism, all the more so when it frequently interrupts the more fragmentary structure of the rest of his music.

He can establish a character instantly and, by subtle changes, reveal his or her innermost thoughts without the cumbersome process of the use of leit motifs in the Wagnerian style. By this statement I do not intend to disparage in any way the great Wagnerian achievements in the development of music drama.

Janacek's music is so different from that of any other composer I know that you may need a couple of repetitions to appreciate its beauty and originality. Once this is done your appreciation and enjoyment of it should be as endless as that of Mackerras himself.

You don't have to wait long to realise the superb quality of sound he produces from his great orchestra. The very first bars of the opera open ppp. swell gradually to pp. and then to piano, the whole quiet, even pastoral sounding introduction filled with underlying sadness. The music swells with a moving sense of drama and then changes into a beguiling dance-like theme, all scored in a manner that I can only describe as inimitable. It is a masterpiece of preparation of what is to follow.

Mackerras never fails to display an incomparable sense of rhythm and lightning changes of mood. He maintains a perfect balance between voices and orchestra throughout the whole work, encouraging the singers when necessary and giving them their heads when the situation demands it.

To go into the subtleties of Soderstrom's performance of this most difficult role would take far more space than is available to me here. To put it as briefly as I can, she never misses a point, either vocal or dramatic. The whole company pays the two principals what is perhaps the greatest possible compliment any combination can pay any director or star — they obviously enjoy every bar. The voices often have that slightly hard sound which the music demands — except, of course, Soderstrom's — and, thank heaven, none of the female singers have that wide wobble that characterises so many Slavic singers.

Most of the cast — again not Soderstrom — are Czech and, even with the aid of the English translation that accompanies the set, most listeners will often find the English libretto a bit hard to follow. I recommend that before playing the opera you spend a little time studying the very useful explanation of Czech pronunciation found at the beginning of the accompanying brochure.

All — orchestra and cast — maintain Janacek's deep sense of humanity, a humanity unimpaired by the destructive activities of the 12-tone school, those musical wreckers who tried to reduce music to a mathematical formula. They have, barring one or two outstanding exceptions, failed ignominiously to do so over a period of over 70 years, though at times they have bullied their way into espousal by trendy, untalented sycophants, of which Australia has more than its fair share.

The moods in this great opera vary from sadness to savagery, from didacticism to glowing love themes. There are no Madam Butterfly facile emotions, fine though that score can be made to sound in the right hands — and throats. Here are characters in the Moussorgsky manner, real people, angry, loving, uncertain sometimes in their reaction to thoughts and deeds that will inevitably destroy them — a veritable Hamlet among operas.

The whole production — and this includes the really first class engineering — offers you a collaboration at all times eloquent, without a dull bar and many quite overpowering ones. And in the libretto there is also a very readable article by Mackerras himself, in which he gives a graphic account of his growing interest in, and affection for, Janacek's works.

Since most of the singers will be strangers — again except Soderstrom — to the average musician I have mentioned by name only the three chief characters among the large cast at the head of this column. (P.S. Mackerras will return to Australia in 1979 to conduct Janacek's Jenufa, which is not unknown to Australian audiences).

Very highly recommended.

Strauss — excerpts from Salome

STRAUSS, RICHARD — Vocal and orchestral excerpts from the opera Salome. Closing Scene. Dance of the Seven Veils. Five songs for voice and orchestra. Montserrat Caballe and the National Orchestra of France conducted by Leonard Bernstein. DGG Stereo Disc 2530 963.

The Salome excerpt starts with the orchestral passage describing Salome's obscene excitement while awaiting the execution of John the Baptist. Then she starts to sing in a disappointingly coarse grained performance of the role, vocally and dramatically. She sounds revengeful rather than lustful, though the ideal reading of the part should be a combination of both. Moreover she is sometimes surprisingly off pitch.

Salome is an immensely difficult role

to bring off successfully and I have heard some great performances in my time, and also some which were far from good. The trouble is that by the time a dramatic soprano acquires the vocal demands of the character, she has reached a size that makes her appearance as a teenage girl look ridiculous. The best looking Salome I ever saw was Lisa della Casa, performing in Munich some years ago. But against that, the memory of our own Joan Hammond galumphing about the stage of the Elizabethan Theatre, Newtown, in the Dance of the Seven Veils still fills me with awe. In terms of Miss Hammond's other accomplishment, golf, she was way over par for the course in Salome. And I wonder how many people remember that Maria Prerauer stepped into the role at a moment's notice without a word, so far as I can recall, having been written about her feat.

Bernstein's reading of the orchestral part is also far from refined, with far too much runaway excitement and overblown passion. Strauss' sinister richness of orchestration is swamped by something very close to hysteria. And, for the moment, again reverting to the past, there was Marjorie Lawrence's 78 recordings of great merit, especially when the engineering of the 78 period was considered. She gave a less impressive performance live in the Town Hall with, in the absence of an orchestra, an organ accompaniment (for heaven's sake!).

I cannot imagine Caballe ever growing into a great Salome, but she might with further expert coaching in the role, become a very passable one. At present she is loud and soft in the right places, but I found her quite unmoving. The whole production sounded too like a rehearsal awaiting the conductor's final polish. The orchestra makes a grand row but, except in the soft bars, lacks detailed definition. And emotion is splashed all over the place instead of being concentrated on Salome's deadly purpose.

Oscar Wilde wrote his original play in French and Strauss used an almost word for word German translation of the text. But the French orchestra used by Bernstein sounds a bit alien when confronted by this perfervid, boiling score. Anyone who compares the sound produced by the Vienna Philharmonic in the now oldish, complete Solti version of the opera will immediately recognise the difference.

The songs, too, are uneven in quality, again both vocally and orchestrally. The first, Cecilia, she sings beautifully and never pushes her voice up into an ugly register, though I have heard better accompaniments. The restrained and lovely Lullaby is more tranquil and offers some beguiling soft singing. Moreover, here Bernstein's accompaniment is much more acceptable. And the same might be said of the evergreen Morgen. In these, the scoring is much more suited to the French temperament of the orchestra. I Love You is a mess, untidy in voice and orchestra, and Caballe again forces her voice unmercifully.

There is a good deal of playing space left on the first side and Bernstein starts the second with the Dance of the Seven Veils, its sound beautifully recorded, but the playing unimpressive. The delicate playing of the flute and other woodwind at the beginning of the first theme is quite delicious, but the music soon starts to lose its ballet-like quality, though plenty of detail is comfortably audible. And later, a peculiar Massenet-like flavour intrudes.

Bernstein drags the tempo of the big waltz theme for a while in order to mount what he hoped might be an astounding climax, so that the early effect tends to be very ponderous indeed. My impression was that it was taking Salome a long time to get undressed.

Of the songs, I enjoyed best Caballe's superb account of Dedication, with the revised 1940 orchestration under Bernstein really fine. But summing up the whole disc it was not a really good day for anyone — and that includes Strauss.

Schubert, Mahler & Ruckert

SCHUBERT — Schwestergruss. Der Zwerg. Ellen's Songs.
MAHLER — Three songs from Des Knaben Wunderhorn.
RUCKERT — Two Lieder. Jessye Norman (soprano) with Irwin Gage (piano). Philips Stereo Disc 6500412.

I shall never forget the effect on me of the first notes sung by Jessye Norman at a recital in the Sydney Concert Hall last year. They were — and I am not exaggerating — electrifying. Uniform from top to bottom of her unusually large range, produced as effortlessly as if she were speaking, and of a quality of such exquisite timbre and purity, that I was absolutely flabbergasted. As her program progressed she presented every aspect of her art and every example of many varied styles, each as perfect as the last.

I thought here must be the voice of the century; and I was mindful of the greatest of them. I might mention that Miss Norman is very large, monumentally so, and very black with a good looking face that establishes at once her intelligence and amiability.

I must however confess, albeit with a good deal of reluctance, that this disc does not give me all the thrill of that first performance. But please don't mistake me, it is still full of some glorious singing. Side 1 is devoted to Schubert songs, the reverse to Mahler items from his Des Knaben Wunderhorn.

The Schubert numbers, except for the Ave Maria, are blessedly unhackneyed. She starts the first, Schustergruss, a tiny bit unsteadily but soon settles down into some ravishing pianissimos that rise to full throated fortissimos which seem to float effortlessly, each bar perfectly phrased. The second, sinister Der Zwerg, is contrasted with a magnificent dramatic sense against the first. Then comes Raste Krieger, a setting of words by Sir Walter Scott, in the form of a berceuse, presented so smoothly that it would soon have the most recalcitrant child asleep.

In the middle come battle scenes of quite extraordinary descriptive power and the song then returns to the tranquil mood of the beginning. Even in this difficult feat she seems never to need to breathe, so naturally do the lovely sounds emerge.

The fourth is a hunting song, complete with horn accompaniment in jaunty rhythm of a true chase. The Ave Maria she sings with an innocence reminiscent of a convent, without any effort at drama or sentimentality. There is something childlike about it that I find irresistably alluring.

On the Mahler side she gets just the right grisly atmosphere into Das Irdischel Leben, the moving story of a starving child. Her eloquent account of Wo Die Schonen Trompeten Blasen captures all Mahler's bitter irony, interspersed with joy.

Urlicht, taken from Mahler's 2nd Symphony, is begun in a quietly mystical mood that swells into a long, shapely lustrous phase before returning to the original mood. All her other items are on the same level of greatness of interpretation and vocal grandeur.

I mentioned at the beginning of this review that I was ever so slightly disappointed with this disc but on reflection I think it was only Miss Norman's presence that I missed. I am sure that in a concert hall I would have enjoyed the recital as much as the one in the Sydney Concert Hall.

I cannot finish this review without a special word of praise for her accompanist, Irwin Gage.

Lighter Side

Reviews of other recordings

Devotional Records

FINALLY HOME. Sixteen Singing Men, arranged and conducted by Dick Bolks. Stereo, Singcord ZLP-3022S. (From S. John Bacon, 13 Windsor Ave, Waverley, Vic. 3149.)

The jacket credits the program here to "Sixteen Singing Men" but, in all fairness I must also acknowledge the presence of a significant number of "singing women", some assistance from reverberation, and a sparing but sensitive instrumental backing.

But, ingredients aside, it adds up to some very pleasant choral sound, featuring recent Gospel songs and updated arrangements but performed in a sufficiently traditional style to delight those who are growing weary of the "mod" Gospel sound.

Don't worry if the titles are unfamiliar; they're all highly melodic and diction is excellent: Give Them All To Jesus — He Was There All The Time — It Was For You — It Took A Miracle — It Is Finished — Greater Is He That Is In Me — Now Let This Be The Day —All The Time In The World — Learning To Learn — Finally Home.

The recording is clean and well balanced and the sound very smooth. For those who enjoy old-fashioned harmony from a not so old-fashioned group: recommended. (W.N.W.)

THINGS ARE GONNA CHANGE SOME DAY. The Celebration, arranged and directed by Ben Markley. Singcord, Stereo ZLP-3021S. (From S. John Bacon Pty Ltd, 13 Windsor Ave Mount Waverley, Vic. 3149.)

First reaction to the sound on this recording is a mental picture of a large

reverberant auditorium, with a full orchestra ranged behind the Celebration singing group — all responding to the baton of a dedicated conductor. But, from the jacket, one learns with surprise that the orchestral backing was recorded in Wembley, England under Bob Krogstad; the vocals were added later at Alhambra, California. However, I would defy anyone to pick the fact, so smooth is the blend in terms of both timing and mood. A superb piece of production.

The program, a mix of newer and older Gospel songs, employs ambitious modern arrangements that should find wide appeal: God Gave The Song Suite — How Rich Am I — Things Are Gonna Change Some Day — O Love That Will Not Let Me Go — When He Shall Come — 'Tis So Sweet The Trust In Jesus — Swing Low, Sweet Chariot — A Country Road — Be Still My Soul And Listen — It Took A Miracle.

The diction is excellent, the vocal work of the highest standard and the orchestral backing highly appropriate. Add a fine recording, as clean as they come, and it adds up to another album that I can thoroughly recommend. (W.N.W.)

☆ ☆ ☆

FOREVER HIS, BETSY OHMAN Milk & Honey MHI006. Distributed by S. John Bacon Pty Ltd, P.O. Box 345 Mt Waverley 3149.

The record jacket tells us that Betsy Ohman is a new voice on the Gospel music scene and, if this disc is any guide, further appearances will be most welcome.

Her voice is strong and true, with clear enunciation, so you don't miss a word of the ten tracks: There's Something In The Air — I'll Never Be The Same Again — Sweet Song Of Salvation — Take The World But Give Me Jesus — Oh How I Love Jesus — All Your Anxiety — This Little Light Of Mine — The Blood Will Never Lose Its Power — Thank You Saviour — Shepherd Of Love.

The tempo varies from Rock to soft ballad, with a patch of Boogie piano thrown in. The backing group, all listed on the jacket, give an excellent account of themselves. Recommended for youth group listening. (N.J.M.)

Instrumental, Vocal and Humour

KEEP MUSIC ALIVE. Tchaikovsky & Wagner with the Sydney Symphony Orchestra. HMV stereo SMP 0040.

This odd record is the outcome of a promotional concert staged by the Sydney Symphony Orchestra with the theme "Keep Music Alive". According to the sleeve notes the concert was the S.S.O.'s "answer to various suggestions that symphony orchestras may lack relevance to the present age and belong to an elite group". That is probably correct.

The two works recorded are the prelude to the "Mastersingers of Nuremburg" by Wagner conducted by Sir Bernard Heinze and Symphony No. 5 in E Minor by Tchaikovsky, conducted by John Hopkins. These are both enjoyable works although quite different in nature. But they do not seem to be the most appropriate works for promoting the performance of classical music — more like preaching to the converted.

To me, if the Sydney Symphony Orchestra, the ABC and EMI (Australia) Ltd are really interested in keeping music alive, then they will have to use more imagination than this record gives evidence of. I hope many buy this record but in the clamour of the marketplace I think it may be missed. (L.D.S.)

☆ ☆ ☆

MANTOVANI TODAY. World Record WRC R 05080.

Originally released on Decca, this disc from Mantovani gives the usual polished performance one expects from this man and his orchestra. In other words a very enjoyable disc, either as background or to listen to for its own sake.

Judging by the fourteen titles, the original release would have been a few

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

years ago: Leaving On A Jet Plane — Midnight Cowboy — Up Up And Away — The Windmills Of Your Mind — Lemon Tree — Wand'rin Star — Theme From 'The Virginian' — Where Is Love — I'll Never Fall In Love Again — Aquarius — Deserted Shore — Good Morning Starshine — Mozart Piano Theme from 'Elvira Madigan' — My Way.

The quality and stereo image are excellent. (N.J.M.)

☆ ☆ ☆

GRACEFUL YEARS, Palm Court Orchestra. ASH BGLP 1002. Astor release.

The name "Palm Court Orchestra" brings visions of cups of tea and cucumber sandwiches, reminiscent of a more leisurely style of living for those that could afford it.

The fourteen old-style dance tunes relate to the second decade of this century and no one alive in those days could escape a pang of nostalgia to hear them again, particularly played in such a pleasing manner as on this disc.

A few of the titles: The Pink Lady — Mighty Lak'a Rose — Lady Of The Lake — Vision Of Salome — Desir Du Moment — The Whirl Of The Waltz — Ragtime Cowboy Joe. Give the record a listen, it will grow on you. (N.J.M.)

☆ ☆ ☆

YOU LIGHT UP MY LIFE. The Magic Organ. Stereo, Interfusion L-25314. Festival release.

Having started off eight or more albums back, with the simulated sounds of a fairground organ, the Magic Organ seems gradually to have moved to a straight-out strict tempo formula appropriate for dancing or party games. Be that as it may, the "magic organist" Jerry Smith seems to have acquired a fan club whose address in Nashville, Tennessee, is given on the jacket.

The titles on this album include: Chatanooga Choo Choo — You Light Up My Life — Southern Nights — Don't It Make My Brown Eyes Blue — American Patrol — King Tut Polka — Blue Eyes Crying In The Rain — Heartaches — Wonderland World — Lucille — Joplin Junction.

The recording quality is clean which isn't surprising, considering that the dynamics are as rigidly controlled as the tempo. (W.N.W.)

☆ ☆ ☆

THE MILLS BROTHERS. A Collection of Golden Performances. Stereo, ABC Records, ABCA 30022. RCA release.

I must confess to being initially puzzled by this ABC release. The colour and styling of the jacket, the pen drawing of four relatively young men, and the notes which recall their prominence in the early thirties, all suggest a re-release of their early recordings. Compounding this is the omission of any reference to stereo or stereo re-processing.

But it is immediately obvious that the recordings are indeed in stereo, which either had to mean a much more recent origin or, less likely, some very smart over-dubbing with a new stereo backing. I'll settle for the former, because of the clean quality and freedom from background noise.

But, that aside, you get a generous program of eighteen songs, mainly in close harmony, with bright instrumental backing. Here's a sampling of the titles: Glow Worm — Chanson D'Amour — Standing On The Corner — Moon River — The Jones Boy — Lazy River — Canadian Sunset — My Shy Violet — I'll Be Around — Paper Doll.

OKLAHOMA. Motion Picture Soundtrack. Stereo, World Record Club, WRC R-04666.

When the film was shown recently on television, someone remarked to me that they found the songs somewhat less satisfying than when presented by present-day top line artists. Perhaps one could argue along these lines but that doesn't mean that there's much to complain about, really, in the performances of Gordon MacRae, Shirley Jones, Charlotte Greenwood and others of the original cast. And, heard in full stereo, the orchestra is fine.

The 12 tracks are as follows: Overture — Oh, What A Beautiful Morning — The Surrey With The Fringe On Top — Kansas City — I Cain't Say No — Many A New Day — People Will Say We're In Love — Poor Jud Is Dead — Out Of My Dreams — The Farmer And The Cowman — All Er Nothin' — Oklahoma.

If you saw the film in the theatre or on TV, this album will be enjoyed as a reprise. Even if you didn't see the film, the music of this well known Rogers and Hammerstein musical is very easy to take, with its blend of melody, rhythm and humour. A good one. (W.N.W.)

If you're old enough to remember the Mills Brothers in their heyday, — or if you've since grown to like their style — you'll have no difficulty in enjoying this piece of nostalgia. (W.N.W.)

☆ ☆ ☆

LARRY GATLIN, OH BROTHER Monument L 36655 Festival release.

Larry Gatlin comes from a family background of Gospel and country music and this reflects in this album of his own songs, recorded in places as widespread as London, Los Angeles and Nashville.

The ten tracks are: Do It Again Tonight — I've Done Enough Dying Today — L.A. You're A Killer — I've Got You — Standin' By Me — Night Time Magic — You Happened To Me — Nothin' You Do — Cold Day In Hell — Everything I Know About Cheatin'.

His diction leaves nothing to be desired, so there is no problem following the lyrics. I think this is a talent we will see more of in the future. (N.J.M.)

☆ ☆ ☆

QUINCY JONES, SOUNDS. A&M L36551. Festival release.

Quite a mixture from Quincy Jones and his crew on this, ranging from disco to protest and songs of empty love.

There are seven lengthy tracks: Stuff Like That — I'm Gonna Miss You In The Morning — Love, I Never Had It So Good — Tell Me A Bedtime Story — Love Me By My Name — Superwoman — Takin' It To The Streets.

The credits on the inner sleeve look like a "Who's Who" of today's musical talent in terms of session musicians and the technical excellence of the whole deal make an exciting record to listen to. (N.J.M.)

☆ ☆ ☆

MOVIE FEVER, ENOCH LIGHT. Project 3 L 36634 Festival release.

If you like your movie themes with plenty of disco flavour, give this disc a hearing, with ten themes from recent and current movies: Rocky — Close Encounters Of The Third Kind — The Goodbye Girl — Star Wars — Saturday Night Fever — A Star Is Born — The One And Only — You Light Up My Life.

The disc bears the usual Enoch Light stamp of very high technical quality, with skillful use of the stereo stage. (N.J.M.)

☆ ☆ ☆

BRUCE COCKBURN, Circles In The Stream. Interfusion L70091/2. Festival release.

I had never heard of Bruce Cockburn before this record, more the pity as he produces some excellent music in the folk idiom. If this double album, recorded in Toronto is a true sample I feel sure he will soon have a following out here. There are seventeen titles, with the lyrics in French and English on the sleeves: The Pipes, The Pipes — Star

Wheel — Never So Free — Deer Dancing Round A Broken Mirror — Homme Brulant — Free To Be — Mama Just Wants To Barrelhouse All Night Long — Caderidris — Arrows Of Light — One Day I Walk — Love Song — Red Brother Red Sister — Lord Of The Star Fields — All The Diamonds In The World — Dialogue With The Devil — Joy Will Find A Way — God Bless The Children.

The instrumental treatment is unusual, with Oriental overtones. In all, an album that grows on one. (N.J.M.)

☆ ☆ ☆

THREE'S A CROWD. The trio. Batjazz BAT2068. RCA release.

George Golla is no stranger to the local music scene and on this outstanding record gets together with Tony Ansell (keyboards and percussion), Stuart Livingston (Vibes, drums and percussion), Doug Gallacher (percussion) and Janice Slater (vocals).

Three of the ten tracks: Time After Time — Solitude — Play Off — are recorded direct to a two track master without any pre-mixing, and the effect is quite startling; you are really there in the middle, the sound is so "live".

The other tracks are not far behind in quality. They are: Feelin' Feline — Good Times Passing — Too Marvellous For Words — How Insensitive — But Beautiful — Minha Saudade — Night Moves.

Janice Slater's vocals on "How Insensitive" and "Night Moves" are a pleasure to listen to but I'm still puzzled by the last track "Play Off"; it lasts only 25 seconds.

To sum up, superb local jazz. (N.J.M.)

☆ ☆ ☆

THE GLORY THAT WAS GERSHWIN. Frank Chacksfield & His Orchestra. Stereo, World Record Club WRC-R.03818.

Featuring the big, dynamic orchestra of Frank Chacksfield and the compelling music of Gershwin, this is very much an album to be listened to, rather than treated as background music.

There are nine tracks altogether: "Porgy & Bess" Introduction; I Got Rhythm — The Man I Love — Embraceable You — Rhapsody In Blue — Fascinatin' Rhythm — But Not For Me — Strike Up The Band — Liza — Suite From "Porgy & Bess".

Released originally by Decca, the recording is clean and well balanced, with the strongest potential appeal to those who prefer something more distinctive than the soft lights and sweet music kind of sound. (W.N.W.)

☆ ☆ ☆

THE BEST OF ENOCH LIGHT. Project 3 L458II/12 Festival release.

Enoch Light Fans have a feast in this double album of the best tracks he has put down with his Orchestra over recent years, twenty two in all.

Here are some of them: April In Portugal — Light My Fire — Marrakesh Express — With A Little Help From My Friends — What A Difference A Day Makes — Alfie — The Windmills Of Your Mind — Hey Jude — People Got To Be Free — My Foolish Heart — Help Yourself.

Some of the solo artists featured include Tony Mottola, Stan Freeman and Doc Severinsen. Enoch Light's well known technical expertise in the recording field is well to the fore in the quality department, making a record well worth keeping. (N.J.M.)

History according to Borge!

VICTOR BORGE in Excerpts from "My Favourite Intervals". Stereo, 2-record set, Astor NSPD-502. $8.95. (Also available on cassette.)

Introducing this double album, Kenneth Robinson, broadcaster and writer for "Punch", describes Victor Borge as "the funniest man I've ever come across". And, indeed, Borge can be transparently funny at the keyboard, in ways which Kenneth Robinson enlarges upon in his notes.

But the humour is of a quite different character in this recording, which is composed essentially of readings from Borge's book "My Favourite Intervals".

One at a time, he nominates various famous composers, explains when and where they lived and uses a brief — and usually brilliant — orchestral snippet as an example of their work. Then follows the Borge version of their life story, a mixture of fact, fancy, whimsy and more miniscule musical segments.

Composers who receive the treatment are Bach, Beethoven, Handel, Mozart, Offenbach and Rossini. If you're well up on your classical literature, you'll know when to nod, when to raise your eyebrows, when to titter and when to guffaw out loud. Come to think of it, I might send this one on to Julian Russell, so that he can speak for the classical music buffs to whom it is directed. (W.N.W.)

Australian and NZ Broadcasting Services

Australian Medium Wave Stations

kHz	Call	Location	Type	Watts
531	2KM	Kempsey	c	2k
	3UL	Warragul	c	2k
	4KZ	Innisfail-Tully	c	5k
	6DL	Dalwallinu	n	10k
540	4QL	Longreach	n	10k
	7SD	Scottsdale	c	5k
549	2CR	Orange	n	50k
558	4GY	Gympie	c	2k
	4AM	Atherton	c	5k
	6WA	Wagin	n	50k
	7BU	Burnie	c	2k
567	2BH	Broken Hill	c	500
	4JK	Julia Creek	n	10k
	6MN	Mount Newman	n	100
576	2FC	Sydney	n	50k
594	3WV	Horsham	n	50k
603	6PH	Port Hedland	n	2k
	7ZL	Hobart	n	10k
612	6NM	Northam	n	200
	4QR	Brisbane	n	50k
621	3AR	Melbourne	n	50k
630	4QN	Townsville	n	50k
	7QN	Queenstown	n	400
	6AL	Albany	n	400
639	5CK	Port Pirie	n	10k
	4MS	Mossman	n	1k
648	2NU	Tamworth	n	10k
	6GF	Kalgoorlie	n	2k
657	2BY	Byrock	n	10k
	8DR	Darwin	n	2k
675	2CO	Albury	n	10k
	6BE	Broome	n	50
	8KN	Katherine	n	50
684	2KP	Kempsey	n	10k
	6BS	Busselton	n	4k
	8TC	Tennant Creek	n	1k
693	4KQ	Brisbane	c	5k
	5SY	Streaky Bay	n	2k
702	2BL	Sydney	n	50k
711	4QW	St George	n	10k
	7NT	Launceston	n	10k
720	2ML	Murwillumbah	n	400
	4AT	Atherton	n	4k
	6WF	Perth	n	50k
	3MT	Omeo	n	2k
	2AN	Armidale	n	50
729	5CL	Adelaide	n	50k
738	2NR	Grafton	n	50k
747	4QS	Toowoomba	n	10k
756	4QA	Mackay	n	2k
	6KW	Kununurra	n	100
	2TR	Taree	n	2k
765	2BE	Bega[1]	c	2k
	2BE	Moruya (Translator)	c	500
774	3LO	Melbourne	n	50k
783	4TO	Townsville	c	780
	2KA	Katoomba	c	2k
	6VA	Albany	c	2k
792	4QG	Brisbane	n	10k
801	2EA	Sydney	e	500
	4QY	Cairns	n	2k
	5RM	Renmark	c	2k
810	2BA	Bega	n	10k
	6WN	Perth	n	10k
819	2GL	Glen Innes	n	10k
828	3GI	Sale	n	10k
	6GN	Geraldton	n	2k
	4NA	Nambour	c	5k
837	4RK	Rockhampton	n	10k
	6ED	Esperance	n	1k
	7QT	Queenstown	c	500
	3CR	Melbourne	c	250
846	2CY	Canberra	n	10k
	4CA	Cairns	c	2k
	6CA	Carnarvon	n	200
855	4QB	Maryborough	n	10k
	4QO	Eidsvold	n	10k
864	4GR	Toowoomba	c	2k
	6AM	Northam	c	2k
	7HO	Hobart	c	2k
873	2GB	Sydney	c	5k
	6DB	Derby	n	2k
882	3YB	Warrnambool	c	2k
	6PR	Perth	c	2k
	4BH	Brisbane	c	5k
891	5AN	Adelaide	n	50k
900	2LM	Lismore	c	2k
	6BY	Bridgetown	c	2k
	7AD	Devonport[1]	c	2k
	8HA	Alice Springs	c	2k
918	2XL	Cooma[1]	c	2k
	4VL	Charleville[1]	c	2k
	6NA	Narrogin	c	2k
927	3UZ	Melbourne	c	5k
	4CD	Biloela (Translator)	c	
	4CD	Gladstone	c	2k
	6NR	Perth		
936	4AY	Ayr	c	5k
	7ZR	Hobart	n	10k
945	3BO	Bendigo	c	2k
954	2UE	Sydney	c	5k
963	6TZ	Bunbury	c	2k
	4WK	Warwick	c	5k
	2RG	Griffith[1]	c	2k
972	2MW	Murwillumbah	c	2k
	5DN	Adelaide	c	2k
981	3HA	Hamilton	c	2k
	4RO	Rockhampton	c	2k
981	6KG	Kalgoorlie	c	2k
990	8GO	Gove	n	500
	6PM	Perth	c	2k
999	2NB	Broken Hill	n	2k
	2ST	Nowra	c	5k
1008	2XX	Canberra		300
	4IP	Ipswich	c	5k
	6GE	Geraldton	c	2k
	7EX	Launceston	c	2k
1017	2KY	Sydney	c	5k
	6WH	Wyndham	c	100
1026	3DB	Melbourne	c	5k
	4MK	Mackay	c	5k
	6NW	Port Hedland		
1044	2UH	Muswellbrook	n	1k
	5PI	Crystal Brook	c	2k
	4WP	Weipa	n	500
1053	2CA	Canberra	c	5k
1071	3CV	Maryborough	c	5k
	4SB	Kingaroy	c	2k
	6WB	Katanning	c	2k
1080	2MO	Gunnedah[1]	c	2k
	4MI	Mount Isa	n	200
	6IX	Perth	c	2k
	7HT	Hobart	c	2k
1089	2GZ	Orange	c	2k
	3WM	Horsham	c	2k
1098	4LG	Longreach	c	2k
	6MD	Merredin	c	2k
	7LA	Launceston	c	2k
1107	2UW	Sydney	c	5k
1116	3EA	Melbourne	e	500
	4BC	Brisbane	c	5k
1134	2AD	Armidale	c	2k
	3CS	Colac	c	2k
	6CI	Collie	c	2k
1143	2HD	Newcastle	c	2k
1152	2WG	Wagga	c	2k
1161	4MB	Maryborough	c	2k
	5PA	Naracoorte	n	10k
	7FG	Fingal	n	1k
1170	2CH	Sydney	c	5k
	4GC	Charters Towers	c	2k
1179	3KZ	Melbourne	c	5k
1188	2NZ	Inverell	c	2k
	6XM	Exmouth	n	2k
1197	4GG	Gold Coast	c	2k
	5KA	Adelaide	c	2k
1206	2GF	Grafton	c	2k
	6KY	Perth	c	2k
	2CC	Canberra	c	5k
1224	2WS	Sydney	c	5k
1233	2NC	Newcastle	n	10k
1242	3TR	Sale	c	2k
	8DN	Darwin	c	2k
1242	5AU	Port Augusta	c	2k
	4AK	Oakey	c	2k
1251	2DU	Dubbo	c	2k
1260	3SR	Shepparton	c	2k
	6KA	Karratha		
1269	2SM	Sydney	c	5k
1278	3AW	Melbourne	c	5k
1287	2TM	Tamworth	c	2k
1296	4BK	Brisbane	c	5k
	5SE	Mount Gambier	c	2k
1314	3BA	Ballarat	c	5k
	2WL	Wollongong	c	2k
1323	5AD	Adelaide	c	2k
	2GO	Gosford	c	2k
1332	3SH	Swan Hill	c	2k
	4BU	Bundaberg	c	2k
1341	2NX	Bolwarra (Newcastle)	c	2k
1350	3GL	Geelong	c	2k
1359	2LF	Young	c	2k
1368	4LM	Mount Isa	c	2k

kHz	Call	Location	Type	Watts
	2GN	Goulburn	c	2k
1377	3MP	Melbourne	c	5k
	8AL	Alice Springs	n	200
1386	5AA	Adelaide	c	5k
1395	2LT	Lithgow	c	500
1404	2PK	Parkes	c	2k
1413	2KO	Newcastle	c	2k
1422	3XY	Melbourne	c	5k
1431	2WN	Wollongong	n	2k
1440	2CN	Canberra	n	2k
1449	2MG	Mudgee	c	2k
1458	2NM	Muswellbrook[1]	c	2k
	5MU	Murray Bridge[1]	c	2k
1467	3MA	Mildura	c	2k
1476	4ZR	Roma[1]	c	2k
	2KA	Penrith (Translator)	c	2k
1485	2LG	Lithgow	n	200
	4HU	Hughenden	n	50
	5LN	Port Lincoln	n	200
1494	2AY	Albury	c	2k
1503	2BS	Bathurst[1]	c	5k
	3AK	Melbourne	c	5k
1512	2NA	Newcastle	n	10k
1521	2QN	Deniliquin	c	2k
1530	2VM	Moree	c	2k
1539	2JJ	Sydney	n	10k
1548	4QD	Emerald	n	50k
1557	2RE	Taree	c	2k
1566	4GM	Gympie	n	200
	3NE	Wangaratta	c	2k
1575	200	Wollongong	c	
1584	5MG	Mount Gambier	n	200
	5WM	Woomera	n	50
	7SH	St Helens	n	100
	2WA	Wilcannia	n	100
1593	4SO	Southport	n	200
	5MV	Renmark	n	2k
1602	2CP	Cooma	n	50
	3WL	Warrnambool	n	200
	5LC	Leigh Creek	n	50
	2CT	Campbelltown	c	100

c commercial broadcasting station; n national broadcasting station; e ethnic; 2 New South Wales and the Australian Capital Territory; 3 Victoria; 4 Queensland; 5 South Australia; 6 Western Australia; 7 Tasmania; 8 Northern Territory.

Australian Frequency Modulation Stations

MHz	Call	Location	Watts	Polarity	Operator
92.1	7CAE-FM	Hobart	1k	H	Tasmanian College of Advanced Education
	6UWA-FM	Perth	5k	H or M	University of Western Australia
	ABC-FM	Adelaide	50k	H	Australian Broadcasting Commission
92.3	2ARM-FM	Armidale	0.1k	M	University of New England
	2MCE-FM	Bathurst	1.6k	V	Mitchell College of Advanced Education
92.5	2NCR-FM	Lismore	1.5k	H or M	Northern Rivers College of Advanced Education
92.9	ABC-FM	Sydney	50k	H	Australian Broadcasting Commission
93.7	3MBS-FM	Melbourne	10k	H	Music Broadcasting Society of Victoria
101.9	ABC-FM	Canberra	50k	V	Australian Broadcasting Commission
102.1	4ZZZ-FM	Brisbane	5k-10k	H or M	Creative Broadcasters Limited
102.5	2MBS-FM	Sydney	10k	H	Music Broadcasting Society of New South Wales
102.7	3RRR-FM	Melbourne	3k	H	Royal Melbourne Institute of Technology
103.5	2CBA-FM	Sydney	—	—	Christian Broadcasting Association
	3GCR-FM	Churchill	1k	M	Gippsland Institute of Advanced Education
103.9	2NUR-FM	Newcastle	3k	C	University of Newcastle
105.7	ABC-FM	Melbourne	50k	H	Australian Broadcasting Commission
107.5	—	Sydney	—	—	Macquarie University & NNSW Institute of Technology
—	—	Melbourne	—	—	Progressive Broadcasting Service
—	3GCR-FM	La Trobe Valley	—	—	Gippsland Community Radio Society
—	—	Brisbane	—	—	Creative Broadcasters Limited
—	4MBS-FM	Brisbane	—	—	Music Broadcasting Society of Queensland
—	4DDB-FM	Toowoomba	—	—	Darling Downs Broadcasting Society
—	—	Adelaide	—	—	Progressive Music Broadcasting Association
—	—	Adelaide	—	—	Ethnic Broadcasters
—	6UVS-FM	Perth	—	—	University of Western Australia
—	—	Newman	—	—	Newman Community Radio
—	7HFC-FM	Hobart	—	—	Hope Foundation Limited

The polarity of the transmission is indicated with C-circular; H- horizontal; V-vertical; M-mixed.

New Zealand Medium Wave Stations

khz	Call	Location	Watts	kHz	Call	Location	Watts	kHz	Call	Location	Watts
567	2YA	Wellington	100k	954	1XW	Hamilton	2k	1260	3XA	Christchurch	2k
630	2YZ	Opapa	20k	963	3YC	Christchurch	10k	1278	2ZC	Napier	2k
639	4YW	Alexandra	2k	981	1YE	Kaikohe	2k	1296	1ZH	Hamilton	2k
657	2YC	Wellington	60k	1008	1ZD	Paengaroa	10k	1314	2YW	Gisborne	2k
675	3YA	Christchurch	20k	1026	1ZK	Kaitaia	2k	1323	3ZM	Christchurch	2k
720	4YZ	Invercargill	20k		1ZN	Whangarei	2k	1332	1XI	Auckland	5k
747	3ZA	Kumara	2k	1035	2ZB	Wellington	20k	1341	2ZN	Nelson	2k
756	1YA	Auckland	20k	1044	4ZB	Dunedin	10k	1350	1ZC	Rotorua	2k
765	2ZK	Hastings	2.5k	1053	2ZP	New Plymouth	2k	1386	1ZT	Turangi	100
783	2YB	Wellington	20k	1080	1ZB	Auckland	10k	1413	1ZO	Tokoroa	2k
810	4YA	Dunedin	20k	1098	3ZB	Christchurch	10k	1431	4XD	Dunedin	250
819	1YZ	Paengaroa	10k	1116	2YX	Nelson	2k	1449	2YM	Palmerston North	2k
837	1YK	Kaitaia	2k	1134	4YQ	Queenstown	2k	1458	3YW	Westport	2k
	1YX	Whangarei	2k	1143	1YW	Hamilton	2k	1476	1XA	Auckland	5k
846	2ZD	Masterton	2k	1152	3ZC	Timaru	2k	1485	3ZO	Twizel	100
864	4ZA	Invercargill	10k	1161	2ZM	Wellington	2k	1494	1ZA	Taupo	2k
882	1YC	Auckland	10k	1197	2ZW	Wanganui	2k	1512	1ZU	Taumarunui	1k
891	2XW	Wellington	5k	1206	4XO	Dunedin	2k	1521	3YR	Reefton	100
900	4YC	Dunedin	10k	1215	1ZE	Kaikohe	2k	1539	2ZE	Blenheim	1k
918	3YZ	Kumara	10k	1242	1XX	Murapara	100	1557	2ZH	Hawera	2k
927	2ZA	Palmerston North	2k		1XX	Whakatane	2k	1575	3XG	Christchurch	2k
945	2ZG	Gisborne	2k	1251	1ZM	Auckland	2k				

AUSTRALIAN SHORT WAVE STATIONS

The Australian Broadcasting Commission has shortwave broadcasting stations located in several states. These provide a service to distant sparsley populated areas of the commonwealth and territories.

The short-wave service transmits programs obtained as follows: VLI takes NSW regional programs; VLH relays 3AR; VLR relays 3LP; VLM and VLQ take Qld regional programs; VLW takes WA regional programs.

The frequencies on which these stations transmit are varied as necessary to obtain optimum results.

Call	Location	Watts
VLH	Melbourne	10k
VLI	Sydney	2k
VLM	Brisbane	10k
VLQ	Brisbane	10k
VLR	Melbourne	10k
VLW	Perth (two services on two frequencies)	10k and 50k

AUSTRALIAN TELEVISION STATIONS

ACT

Area	Call	Channel Polarity
Canberra	ABC	3-V
	CTC	7-V

New South Wales

Area	Call	Channel Polarity
Sydney	ABN	2-H
	ATN	7-H
	TCN	9-H
	TEN	10-H
Bega-Cooma	ABSN	8-V
Broken Hill	ABLN	2-V
	BKN	7-V
Central Tablelands	ABCN	1-V
	CBN	8-V
Central Western Slopes	ABQN	5-V
	CWN	6-V
Grafton-Kempsey	ABDN	2-H
	NRN	11-H
Illawarra	WIN	4-H
	ABWN	5A-H
Manning River	ABTN	1-V
	ECN	8-V
Mungindi	ABMIN	10-H
Murrumbidgee	ABGN	7-H
	MTN	9-H
Newcastle-Hunter	NBN	3-H
	ABHN	5A-H
Richmond-Tweed	ABRN	6-H
	RTN	8-H
SW Slopes and E Riverina	ABMN	0-H
	RVN	2-H
Upper Namoi	ABUN	7-H
	NEN	9-H

Victoria

Area	Call	Channel Polarity
Melbourne	ATV	0-H
	ABV	2-H
	HSV	7-H
	GTV	9-H
Ballarat	ABRV	3-H
	BTV	6-H
Bendigo	ABEV	1-V
	BCV	8-V
Goulburn Valley	ABGV	3-V
	GMV	6-V
Latrobe Valley	ABLV	4-H
	GLV	10-H
Mildura	ABMV	4-H
	STV	8-H
Murray Valley	ABSV	2-V
Upper Murray	ABAV	1-H
	AMV	4-H

Northern Territory

Area	Call	Channel Polarity
Darwin	ABD	6-H
	NTD	8-H
Alice Springs	ABAD	7-H
Katherine	ABKD	7-H
Tennant Creek	ABTD	9-H

Queensland

Area	Call	Channel Polarity
Brisbane	TVQ	0-H
	ABQ	2-H
	BTQ	7-H
	QTQ	9-H
Alpha	ABAQ	8-H
Augathella	ABAAQ	11-H
Barcaldine	ABBQ	10-H
Blackall	ABBLQ	9-H
Cairns	ABNQ	9-H
	FNQ	10-H
Charleville	ABCEQ	9-H
Clermont	ABCTQ	10-H
Cloncurry	ABCLQ	7-H
Cunnamulla	ABCAQ	10-H
Darling Downs	ABDQ	3-H
	DDQ	10-H
Dirranbandi	ABDIQ	7-V
Emerald	ABEQ	11-H
Goondiwindi	ABGQ	6-H
Hughenden	ABHQ	9-H
Julia Creek	ABJQ	10-H
Longreach	ABLQ	6-H
Mackay	ABMQ	4-H
	MVQ	6-H
Mary Kathleen	ABMKQ	9-H
Miles	ABMSQ	9-V
Mitchell	ABMLQ	6-H
Morven	ABMNQ	7-H
Mount Isa	ABIQ	6-H
	ITQ	8-H
Richmond	ABRDQ	6-H
Rockhampton	ABRQ	3-H
	RTQ	7-H
Roma	ABRAQ	7-H
St George	ABSGQ	8-H
Southern Downs	ABSQ	1-H
	SDQ	4-H
Springsure	ABSEQ	9-H
Townsville	ABTQ	3-H
	TNQ	7-H
Wide Bay	ABWQ	6-V
	SEQ	8-V
Winton	ABWNQ	8-H

South Australia

Location	Call	Channel Polarity
Adelaide	ABS	2-H
	ADS	7-H
	NWS	9-H
	SAS	10-H
Ceduna	ABCS	7-H
Central East	ABRS	3-V
Leigh Creek	ABLCS	9-H
Renmark-Loxton	RTS	5A-V
South East	ABGS	1-H
	SES	8-H
Spencer Gulf North	ABNS	1-V
	GTS	4-V
Woomera	ABWS	7-H

Western Australia

Location	Call	Channel Polarity
Perth	ABW	2-H
	TVW	7-H
	STW	9-H
Bunbury	BTW	3-H
	ABSW	5-H
Carnarvon	ABCNW	7-H
Central Agricultural	ABCW	4-H
Dampier	ABDW	10-H
Esperance	ABEW	10-H
Geraldton	ABGW	6-H
	GTW	11-H
Kalgoorlie	ABKW	6-H
	VEW	8-H
Karratha	ABKAW	7-H
Mt. Newman	ABW	7-H
Moora	ABMW	10-H
Morawa	ABCMW	8-H
Norseman	ABNW	7-H
Port Hedland	ABPHW	7-H
Roebourne	ABRBW	9-H
Southern Agricultural	ABAW	2-V
	GSW	9-V
Southern Cross Bullfinch	ABSBW	9-H

Tasmania

Location	Call	Channel Polarity
Hobart	ABT	2-H
	TVT	6-H
King Island	ABKT	11-H
North Eastern Tasmania	ABNT	3-H
	TNT	9-H

AUSTRALIAN TRANSLATOR STATIONS

Area	Parent Station	Channel Polarity
Australian Capital Territory		
Tuggeranong	CTC-7	10-V
New South Wales		
Armidale	NEN-9	10-H
	ABUN-7	4-H
Batemans Bay-Moruya	ABWN-5A	9-H
	WIN-4	11-H
Bathurst	ABCN-1	6-V
	CBN-8	11-V
Bega (via Bateman's Bay-Moruya)	WIN-11	6-H
Bonalbo	ABRN-6	3-V
	RTN-8	5-V
Bourke-Brewarrina	ABN-2	4-H
Cobar	ABN-2	2-V
	CWN-6	10-V
Cooma	ABSN-8	0-M
	CTC-7	10-V
Deniliquin	GMV-6	10-V
	ABGN-7	9-V
Eden	ABSN-8	1-H
	WIN-6	3-H
Glen Innes	ABUN-7	0-H
	NEN-9	3-H
Gloucester	ABTN-1	6-H
	ECN-8	11-H
Goulburn	ABC-3	0-V
	CTC-7	10-V
Hay	ABGN-7	10-H
	MTN-9	5A-H
Inverell	ABUN-7	2-H
	NEN-9	10-H
Jerilderie	ABGN-7	11-H
	GMV-6	8-H
Kandos-Rylstone	ABCN-1	0-V
	CBN-8	10-V
Khancoban	AMV-10	7-H
Kyogle	ABRN-6	3-V
	RTN-3	5-V
Lithgow	ABCN-1	5-V
	CBN-8	6-V
Menindee	ABLN-2	9-V
Mudgee	CWN-6	9-V
	ABQN-5	11-V
Murwillumbah	RTN-8	5-H
Nyngan	ABN-2	3-V
Portland-Wallerawang	ABCN-1	0-H
	CBN-8	4-H
Tamworth	NEN-9	0-H
Upper Hunter	ABHN-5	2-H
	NBN-3	10-H
Walcha	NEN-9	1-H
	ABUN-7	5-H
Wollongong	WIN-4	3-H
Young	RVN-2	6-H
Northern Territory		
Warrego Mine	ABTD-9	10-H

Area	Parent Station	Channel Polarity
Tasmania		
Burnie	TNT-9	10-V
	ABNT-3	4-V
Derby	TNT-9	11-H
Lileah	TNT-9	6-V
	ABNT-3	8-V
Maydena	TVT-6	8-H
Queenstown-Zeehan	ABT-2	4-H
	TVT-6	8-H
Roseberry-Renison Bell (via Queenstown)	ABT-4	1-H
	TVT-8	10-H
St Helens	ABNT-1	0-H
	TNT-11	7-H
St Marys-Fingal Valley	ABNT-3	1-V
	TNT-9	11-V
Savage River-Luina (via Waratah)	ABNT-2	4-H
	TNT-10	7-H
Smithton	TNT-9	11-V
	ABNT-3	4-V
South Launceston	ANBT-3	1-H
	TNT-9	11-H
	TNT-9	6-V
Strahan (via Queenstown)	ABT-4	10-H
Strathgordon	ABT-2	5-H
	TVT-6	8-H
Swansea-Bicheno	TVT-6	8-H
	ABT-2	4-H
Taroona	TVT-6	8-H
Waratah	ABNT-3	2-H
	TNT-9	10-H
Wynyard	TNT-9	5A-V
	ABNT-3	1-V
Queensland		
Babinda	FNQ-10	6-V
	ABNQ-9	1-V
Blackwater Bluff	ABRQ-3	8-H
	RTQ-7	10-H
Bowen	TNQ-7	1-H
	ABTQ-3	5A-H
Cardstone Village	TNQ-7	5-V
Collinsville	ABMQ-4	8-H
	MVQ-6	11-H
Cracow	RTQ-7	5-H
Dysart (via Goonyella-Moranbah)	MVQ-11	6-V
Gladstone	ABRQ-3	5-H
	RTQ-7	10-H
Goonyella-Moranbah (via Nebo)	MVQ-8	11-H
Gordonvale	FNQ-10	2-H
	ABNQ-9	0-H
Gunpowder	ITQ-8	10-H
Gympie	SEQ-8	1-V
	ABWQ-6	4-V
Mareeba	FNQ-10	6-H
	ABNQ-9	1-H
Monto	ABWQ-6	1-V
	SEQ-8	5-V

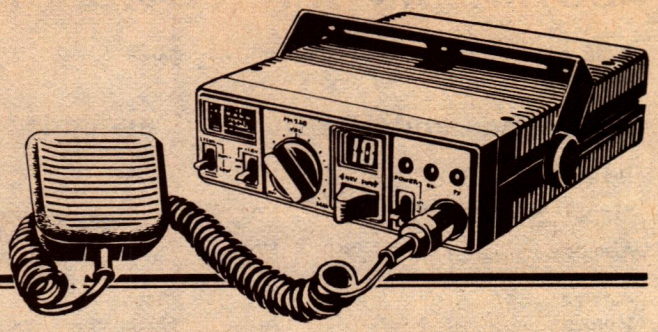
Area	Parent Station	Channel Polarity
Mossman-Port Douglas	ABNQ-4	8-V
	FNQ-5A	11-V
Nambour	SEQ-1	10-H
Nebo	MVQ-6	8-H
North Cairns	ABNQ-9	4-H
	FNQ-10	5A-H
Toowomba	DDQ-10	5A-H
Townsville	TNQ-7	5A-H
	ABTQ-3	1-H
Whitsunday Islands/Shute Harbour	ABMQ-4	2-H
Victoria		
Alexandra	ABGV-3	5A-H
	GMV-6	10-H
Bright	AMV-4	11-H
Corryong/Khancoban	ABAV-1	9-H
	AMV-4	10-H
Eildon (via Alexandra)	ABGV-5A	1-H
	GMV-10	3-H
Myrtleford	ABGV-3	2-H
	AMV-4	9-H
Nhill	BTV-6	7-V
	ABRV-3	9-V
Orbost	ABLV-4	2-V
	GLV-10	7-V
Portland	ABRV-2	4-H
	BTV-6	11-H
Swan Hill	BCV-8	11-V
Warrnambool-Port Fairy	ABRV-3	2-V
	BTV-6	9-V
South Australia		
Bordertown	ABS-2	2-V
Cowell	ABNS-1	6-V
	GTS-4	8-V
Keith	ABS-2	4-V
Port Lincoln (via Cowell)	ABNS-6	3-H
	GTS-8	5-H
Western Australia		
Albany	ABAW-2	7-V
	GSW-9	10-V
Kambalda	VEW-8	3-H
	ABKW-6	5-H
Katanning	ABW-2	4-V
	BTW-3	10-V
Koolyanobbing	ABSBW-9	11-H
Merredin	ABW-2	11-H
Mullewa	ABGW-6	9-H
Narrogin	ABW-2	1-H
Newman	ABW-2	7-H
Pannawonica	ABW-2	11-H
Wagin	ABW-2	8-H
	BTW-3	11-H
Wongan Hills	ABMW-10	6-V

AUSTRALIAN REPEATER STATIONS

Area	Station	Channel Polarity
Western Australia		
Cockatoo Island	CKWR	9-H
Koolan Island	CKWR	7-H
Mount Tom Price	HTWR	7-H
Mount Nameless	HTWR	9-H
Paraburdoo	HTWR	11-H
Newman	NEWR	9-H
Queensland		
Weipa	WEQR	7-H

Area	Station	Channel Polarity
Northern Territory		
Groote Eylandt	GEMR	7-H
Nhulunbuy	GOVR	11-H
Yirkkala Mission	GOVR	9-H

The Australian CB SCENE



CRYSTALS, SYNTHESISERS AND THE PHASE-LOCKED LOOP — Part 2

As distinct from direct crystal control, or the synthesisers discussed in part 1 of this article, many modern CB transceivers use a phase-locked loop system to maintain them precisely on the allotted channels. Without getting too involved, this article seeks to explain what the term means.

by NEVILLE WILLIAMS

The phase-locked loop concept has been around for quite some time, certainly since the 1930s. More recently, it found wide application in the horizontal oscillator circuitry of television receivers, where the principle is used to lock the local oscillator to the incoming sync pulses. It is also fundamental to the design of automatic frequency control (AFC) circuitry in modern colour TV receivers and FM tuners.

Basically, a phase-locked loop — called PLL for short — is an electronic servo system which has the capability of producing an output which is frequency (and phase) locked to some external reference signal.

In its simplest form, as illustrated in Fig. 2, a phase-locked loop involves three basic circuit elements. One is a voltage controlled oscillator, or VCO, whose output frequency is dependent not only on its own circuit constants but on an externally derived DC control voltage. Part of the output signal from the VCO is fed to a phase comparator or detector, which compares it with the incoming reference signal to produce resultants of one kind and another, including a "DC" component whose value reflects any difference between the frequencies being compared. After filtering to remove the original signal components, and possible amplification, the so-called DC component is fed to the VCO.

Assuming that the circuit constants have been suitably arranged, the control voltage will modify the output frequency of the VCO, so that it will lock to the incoming reference frequency. If the latter is absolutely fixed, so also will be the output from the VCO. If the reference frequency varies, for any reason, the output from the VCO will vary with it, provided the time-constant of the control voltage circuitry is not excessively long. In short, the VCO will "track" the reference frequency.

A point to mention in passing is that, while a VCO will lock to a reference signal in terms of frequency, it tends to stabilise with a fixed phase displacement between output and reference signals. It is not important in the present context but will explain why, in some circuitry, a phase difference is noted between the two.

To get back to Fig. 2, however, it will be apparent that a VCO could be locked to a crystal source selected for any CB transmit or receive function. The one obvious objection is that it would be a completely pointless exercise. If a crystal source had to be provided for each channel function, it might be as well be used directly!

Fig. 3 contains an important additional circuit function: a frequency divider in series with the feedback path.

Let's say that frequency divider was set for a ratio of 2:1. The frequency fed back to the phase comparator would be half that of the VCO output, meaning that the VCO could be locked to a frequency twice that of the original reference.

Equally, it could conceivably be locked to four times the frequency or eight times the frequency.

As before, this would seem to be a rather pointless exercise but it provides an important step in the logic. Imagine that the frequency divider was switchable so that it could be set for ratios of 1:1, 2:1, 4:1 and 8:1; fairly obviously, the VCO could now be made to produce four different frequencies, all reference to a single source.

Interesting, but still not apparently relevant to the CB transceiver situation!

The ratios of 2:1, 4:1 and 8:1 were chosen deliberately because they are simple ratios which have been used for decades in conventional receivers and transmitters. In fact, up till not so many years ago, frequency division by other than simple ratios was regarded as rather impractical.

However, the emergence of digital logic technology has changed all that. It is now possible to arrange circuitry, usually in integrated circuit form, which will count up to any desired number of digits, then automatically reset and start counting all over again. In short, by producing one (reset) pulse after any selected integral number of digits, it can effectively divide by that number.

So, if one should wish to divide by 239, digital counting circuitry can be set up to do just that.

Why pick on 239? Because it provides

Right: A basic phase-locked loop.

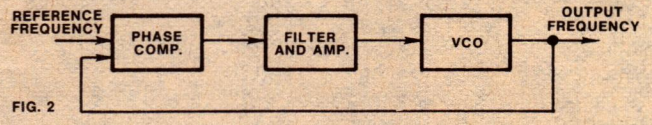


FIG. 2

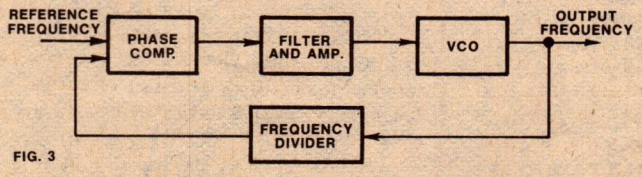


FIG. 3

Left: A basic phase-locked loop incorporating a frequency divider.

a handy example of what we mean.

If we set up digital circuitry to divide by 239 the output from a crystal oscillator set near 2MHz, it will divide its output down to 8366Hz, which is the top "C" note on a typical electronic organ. If we divide the same 2MHz (approx) by 253, we get 7903Hz — equivalent to "B". Divide it by 268 and we get 7460Hz, equivalent to B-flat, and so on down the entire octave.

That kind of complex division involves an integrated circuit especially interconnected internally to provide the integral ratios necessary to produce the notes in a musical octave. It could be described as a "dedicated" IC.

It is possible, however, to produce integrated circuits which will provide a wide variety of division ratios in response to deliberate external manipulation — as, for example, by modifying external connections or voltages by means of a switch. Such an IC is commonly described as a "programmable divider".

Now refer back to Fig. 3 and, in place of the simple divider previously discussed imagine that we insert a programmable divider capable of being set for a variety of ratios no less odd looking (at first glance) but no less deliberate than those nominated for the production of a musical octave.

Fairly obviously, by settling on some appropriate (and fairly low) frequency for the reference, and by setting the programmable divider to a series of critically chosen ratios, the VCO can be made to deliver the range of frequencies required by a CB transceiver, all of them stabilised against the one common reference frequency — logically from a highly stable source.

The foregoing can be expressed in another way, for those who remember their school maths. The design task is to write down the required CB frequencies, determine the highest common factor (which becomes the reference frequency) and set the programmable divider for the relevant ratios.

What of the reference frequency source?

On the assumption that it has to be a relatively low figure, the most practical source is a crystal oscillator whose output is also divided down to the required figure. On this basis, Fig. 3 can be re-drawn as in Fig. 4 to incorporate the reference crystal oscillator/divider.

If the CB channel frequencies were all multiples of 10kHz and all 10kHz apart, the position would be delightfully simple. The crystal derived reference could be 10kHz and, with the programmable divider settable to 2700, 2701, 2702, etc, the VCO would produce frequencies of 27,000kHz, 27,010kHz,

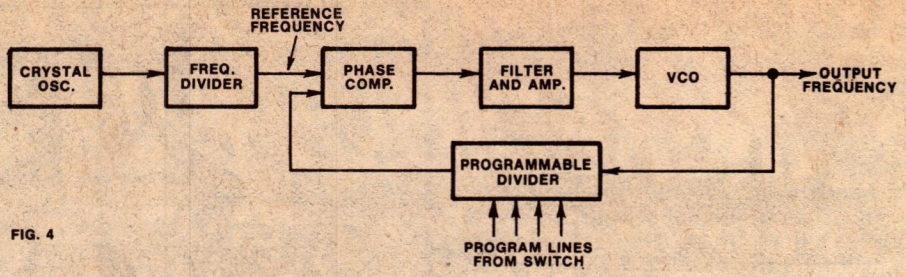


FIG. 4

27,020kHz and so on.

But, while the official CB channels are 10kHz apart in most cases, they are not divisible by 10. with figures like 27.015mHz, 27.02MHz, 27.035MHz, etc, the highest common factor is five (or 5kHz) and some measure has to be taken in the design to accommodate this situation.

For example, the reference frequency might be reduced to 5kHz and the programmable divider switching arranged to select only the appropriate 23 or 40 (American) channels or 18 Australian channels.

Again, the PLL could be set up to produce frequencies 10kHz apart, referenced to 10kHz, but heterodyned up to 27.005kHz and so on by beating with a fixed crystal oscillator containing the odd 5kHz. In short, frequency synthesis (see part 1) in addition to the basic phase-locked loop.

In fact, a variety of schemes have been devised to cover this requirement. There is also the need, in receive mode, to provide a VCO output displaced from the channel frequency by a figure equal to the first intermediate frequency. Yet again, for SSB reception, a further increment of about 3kHz must be provided.

In some cases, these various requirements have been met by the provision of additional crystal oscillators to supplement the basic PLL by frequency synthesis. Even so, the need for two or three supplementary crystals is of little consequence when compared with the needs of alternative methods.

SPECIAL PURPOSE ICs

Not surprisingly, however, integrated circuit manufacturers have come up with custom-designed programmable ICs which offer their own in-built answers to the various problems. Referenced to a single crystal, some of these will produce the transmit frequency and the required receiver "oscillator" frequencies for a double-change multi-mode superhet automatically in response to inputs from the channel selector, mode and send/receive switches.

More than that, their "programming" can be rationalised to correspond with that necessary to operate a LED channel readout, and to respond to pulsed rather than hard-wired input.

You find all this confusing?

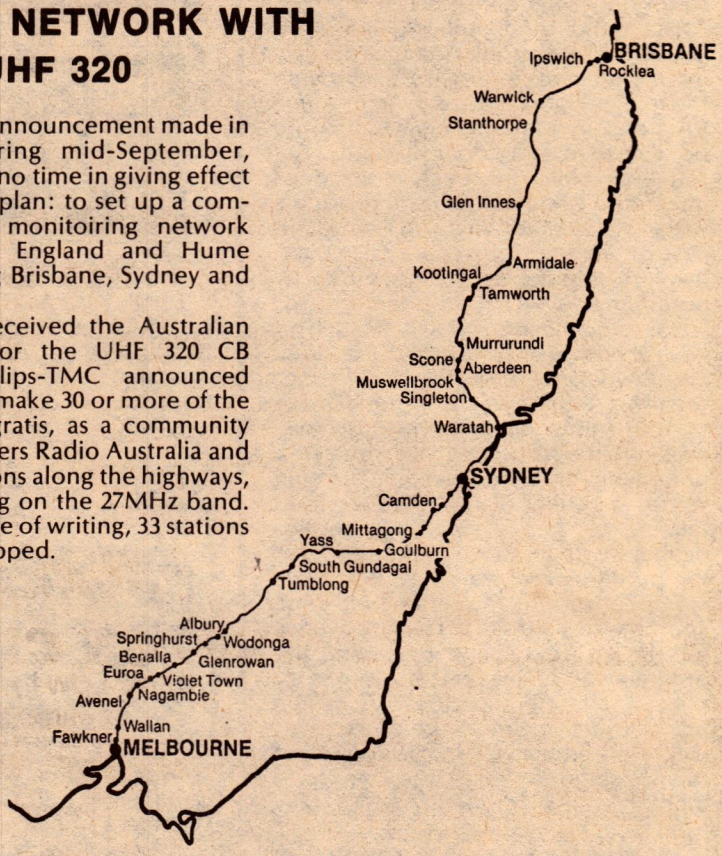
So does just about everyone else who has not had occasion to work closely with modern multi-channel transceiver design!

But, leaving aside these refinements and complications, you will hopefully have gained what we set out to impart — an appreciation of how a voltage controlled oscillator can produce an array of precise frequencies, aided by a reference crystal, a phase-locked loop and a programmable divider.

HIGHWAY NETWORK WITH PHILIPS UHF 320

Following an announcement made in Melbourne during mid-September, Philips have lost no time in giving effect to an ambitious plan: to set up a complete UHF CB monitoiring network along the New England and Hume highways linking Brisbane, Sydney and Melbourne.

Having just received the Australian design award for the UHF 320 CB transceiver, Philips-TMC announced that they would make 30 or more of the units available gratis, as a community service, to Truckers Radio Australia and Big Wheels stations along the highways, already operating on the 27MHz band. In fact, at the time of writing, 33 stations have been equipped.



The main role of the stations is to assist and cooperate with professional drivers using the highways — a task which is often made difficult on 27MHz by noise and interference and by CB "idiot" behaviour. The new UHF FM equipment offers substantial relief from these problems, with an exceptional degree of speech clarity as a further bonus.

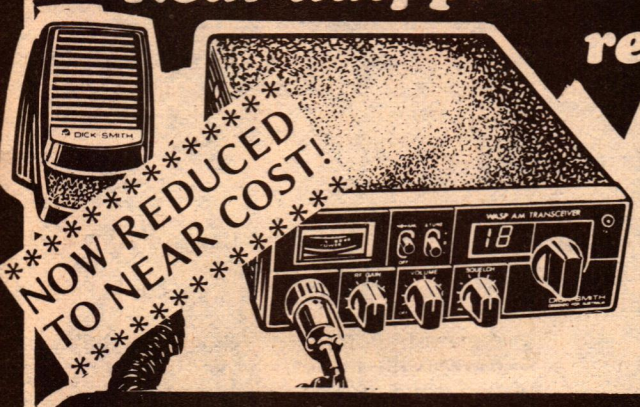
Mr Graham Evans, National Director of Truckers Radio Australia, says that his organisation is keen to promote the exclusive use of UHF channel 40 (477.400MHz) for highway communication, primarily by professional drivers. However, TRA stations would cooperate with responsible private drivers on the highway channel, in respect to road conditions, directions and emergency situations.

"In return for that service on the highway, TRA will beg the indulgence of UHF users to leave channel 40 alone in the cities for the use of truckers".

"So we offer a service on the highway, and they give us a go in the city".

INCREDIBLE BUT TRUE!

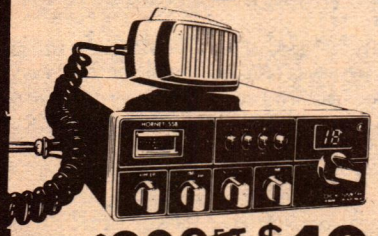
Near half price! WASP CB reduced to $69.50



SAVE $60 THE CB BARGAIN OF THE YEAR!

Thousands of these advanced Wasp CB's from Dick Smith sold for $129.50 — now look at the price. Hurry — this is your last chance to buy at this incredible bargain price. Next shipment must at least double (even treble) in price as a result of import duty and deteriorating exchange rate. HURRY IN FOR YOUR WASP NOW! Cat D-1520

Huge savings on SIDEBAND sets



HORNET MOBILE

The set with a sting - reduced to a price that won't hurt!

LED readout, maximum legal power. Save an incredible $100!

~~$299.50~~ **$199.50** Cat D-1720

HURRY!

SCORPION BASE

Designed and built as a base station: 240 & 12 volt operation, large 'S' & power/SWR meters, LED readout:

Save $50.00 NOW!

Cat D-1740 ~~$349.50~~ **$299.50**

PRICES SLASHED ON CB ACCESSORIES TOO

RUSH THESE — AT SUCH LOW, LOW PRICES THEY WON'T LAST LONG.

DELUXE ALTERNATOR FILTER
Ferrite core — for really tenacious alternator whines.
Cat. A-7926 WAS $9.50 SAVE $3.00 NOW $6.50

WHITE FLASH HELICAL ANTENNA
The famous 'top adjust' helical antenna complete with base, lead-in coax and plug. Cat D-4076 WAS $29.00 NOW $19.50

GUTTER MOUNT ANTENNA
Simply clips on the rain gutter of any vehicle. Complete with lead & plug. Cat. D-4411 $16.50

MAGNETIC BASE ANTENNA
Centre-loaded, stainless steel construction with strong magnetic base. Lead & plug included. Cat D-4412
WAS $22.50 SAVE $6.00 NOW $16.50

CB/FM/BC ANTENNA
Three antennas in one! Locks down when not in use. All connecting cables and fittings supplied. Cat. D-4418
WAS $32.50 SAVE $3.00 NOW $29.50

ELECTRIC CB/FM/BC ANTENNA
Similar to D-4418 above with the added convenience of electrical operation controlled from dashboard switch.
Cat. D—4419 WAS $65.00 SAVE $15.55 NOW $49.50

WHITE NIGHT TOP LOADED ANTENNA
Fibreglass antenna with exclusive 'Power Coil'. Complete with roof mount base, trunk tip mount, cable & plug. Cat. D-4452
WAS $29.50 SAVE $11.00 NOW $18.50

MAGNETIC BASE
Uses a powerful base so no need to drill holes in car roof. Nylon gasket prevents scratching. Cat D-4622
WAS $25.00 SAVE $9.50 NOW $15.50

ANTENNA MATCHBOX
Connect into antenna lead. By adjusting four knobs virtually all mismatch between antenna and rig can be eliminated.
Cat..D-5512 WAS $15.00 SAVE $2.50 NOW $12.50

CB ANTENNA ELIMINATOR
Enables you to use your car radio airial for your CB and car radio. Cat. D-5516 WAS $29.50 SAVE $5.00 $24.50

SWR/POWER/FIELD STRENGTH METER
Get the best out of your rig by ensuring antenna is SWR'ed properly & transmitter is putting out maximum legal power.
Cat Q-1352 WAS $21.50 SAVE $6.00 NOW $15.50

27MHz TESTER
A must for CB servicemen & serious CBers. Measures SWR, power, modulation, field strength, checks crystals too.
Cat. Q-1380 WAS $59.50 SAVE $10.00 NOW $49.50

Mail Orders? Certainly! Add the following amounts for delivery: Order value $5.00 — $9.99 P & P $1; $10 — $24.99 P & P $2; $25 — $49.99 P & P $3; $50 — $99.99 P & P $4; $100 or more P & P $5.50

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Wireless Institute educational service report

The Wireless Institute of Australia Youth Radio Service, incorporating the novice licence trial examination program, has been responsible for a large percentage of the successful candidates for an amateur licence.

The International Telecommunication Union, Radio Regulation 1-78, defines the amateur service as "—a service of self training, intercommunication and technical investigations carried out by amateurs; that is, persons interested in radio techniques solely with a personal aim and without pecuniary interest."

That definition certainly applies to the work associated with the WIA education service.

Educational activities are organised within each state division of the WIA by Youth Radio Scheme committees, members of various school or college radio clubs, or amateur clubs who, as an extension of the clubs' activities, conduct classes for amateur licence candidates.

On the other hand, the WIA federal education committee, co-ordinated by Graeme Scott, VK3ZR, through its collaboration with the P&T radio branch officers, has been responsible for a number of improvements in the format and other aspects of amateur licence examinations; in particular, the preparation and issue of a syllabus for the novice licence.

A bank of multi-choice format questions for the novice examination, prepared in consultation with YRS state education officers, and based on the syllabus, was presented to the radio branch for use at examinations.

New South Wales appears to have the most intensified YRS activity, with 56 clubs registered during 1978. Of these, 26 provide novice licence training, 16 follow the YRS courses and participate in the certificate examination provided by them, and 12 provide general interest electronics where members construct simple electronic projects that provide almost instant satisfaction to the builder. Seven clubs follow standard "Manual Arts" style courses designed by the teacher and run for a few periods each week. Pupils build graded projects, do theory study, and sit for school examinations in electronics, but find the YRS notes and other assistance helpful.

One club, at the Armidale High School, conducts a senior one-year course, with three periods a week, under the category "Other Approved Course". This course leads to the amateur operators limited certificate of proficiency (AOLCP).

The situation in Victoria is not fully known. There are at least 22 clubs associated with YRS activity, but few details have come to hand.

The Midland Zone of the Victorian Division of the WIA reports a number of classes in its area. At the Golden Square High School, Bendigo, 30 students attended novice classes, while another 14 elected to attend preliminary classes based on NSW YRS notes. These classes were conducted by Bob Lukeis, VK3BRL, with assistance from some parents and Bob's wife.

Another course at novice licence level was conducted at the Bendigo Technical College by Ken Slade, VK3ZGS and Alec Wilson.

At the Echuca Technical College, George Loft, VK3AGM conducted a novice licence course and successful students at AONCP examinations went on to study for the AOCP.

The Midland Zone will hold classes for the three levels of amateur licences during 1979. Enquiries should be directed to the secretary Bill Clark, VK3FY, High Street, Kangaroo Flat, Vic. 3555 or telephone (054) 47 7274.

In Northern Territory at the Casuarina High School, near Darwin, an active club operating under the call VK8CH has received a school commission grant of $1087. The grant has been used to equip the station for demonstration and practical training towards the novice licence. The club is under the supervision of teacher David Boehm, VK8DB.

In the other states it is understood that educational activity is available at a number of flourishing clubs at various centres.

During 1978, three amateur radio weekends were conducted by the NSW YRS, co-ordinated by Reverend Bro Cyril Quinlan, VK2ACQ, at the Mount St Mary's Conference Centre, Katoomba. Two nights accommodation and meals plus lectures on radio theory, propagation, and Morse code was provided for $17 a person. Trial examinations at novice licence level were also conducted.

(Details of radio weekend January 1979 given elsewhere in these notes.)

Publications available for those interested in the novice licence are: "Manual of Questions and Answers" — by Keith Howard, VK2AKX. This is a short course in radio for candidates for the AONCP and is available from the Westlakes Radio Club, PO Box 1, Teralba, NSW 2284. Price $4.50 post paid.

"1000 Questions for Novice Candidates", and "50 Basic Electronics Projects" — produced by the WIA NSW Division Education Service. Price $3.00 and $1.50 respectively post paid. Available from D. R. Wilson, PO Box 109, Toongabbie, NSW 2146. Cheques should be made out to — WIA Education Service.

"Zero Beat", published quarterly, is the national magazine of the YRS, available on a subscription basis. It contains details of YRS activities, technical articles, and simple projects. The editor is Ken Hargreaves, VK2AKH, 52 Marlin Avenue, Floraville, NSW 2280. All correspondence should be directed to Ken.

Also available is a Self Study Kit for the novice. This kit contains the Manual of Questions and Answers; 1000 Questions; Learning Morse Code (book and two C60 cassette tapes) and

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR RADIO

other material. Price $15.00. Available from D. R. Wilson.

The work done by those associated with the WIA education service is on a purely voluntary basis, the only charges made are to cover cost of materials, postage, etc.

If you are interested in radio communication or electronics, the WIA education service provides the opportunity to expand your knowledge. Science teachers have found the YRS courses very helpful in the formation of clubs among interested students, as have the organisers of various youth groups.

For details of the WIA Education Service contact the secretary, WIA Division, in each state. In NSW the YRS state supervisor is Ken Hargreaves, VK2AKH, 52 Marlin Avenue, Floraville 2280.

Reference to the Australian Radio Club Directory published last month in these notes may provide details of a direct contact in your local area.

GENEROUS GIFT TO YRS

In October, 1978, a most generous gesture was made by Dick Smith Electronics. A large range of electronic and radio equipment consisting of surplus warehouse stock, samples, shop soiled returns, etc, including transceivers, multimeters, speakers, antennas, transformers and a large selection of assorted components, was donated to the WIA federal education section for sale and auction for the benefit of youth radio work throughout Australia.

The sale was conducted at Wireless Institute Centre, 14 Atchison Street, Crows Nest on Saturday, October 28, 1978 and yielded a gross amount exceeding $3500. This will be shared among all divisions of the WIA.

There is no doubt that such a fine gesture will be appreciated by WIA members and will be the means of assisting many to become engaged a very worthwhile hobby — amateur radio.

AMATEUR RADIO WEEKEND

Following the success of study weekends held prior to the May, August and November P&T Dept examinations during 1978, the first of this year's pre-examination courses will take place over the Australia Day weekend, allowing an extra day for intensive study.

Again the venue will be the Mount St Mary's Education Centre at Katoomba, NSW, on the Great Western Highway opposite the police station. Being an ex-boarding school it is an ideal venue for a live-in study situation.

As well as providing the final brush-up and evaluation for those attempting the full call exam in February, lectures will be available for novices and persons seeking an introduction to amateur radio.

Reverend Bro Cyril Quinlan, VK2ACQ, who was the instigator and convenor of these weekends has, due to pressure of work, requested the following to act as convenors: Les Dickenson, VK2NMY, Sel Carlyle, VK2NOK and Ken James, VK2NWK.

Date: 8 pm, Friday, January 26, 1979, to 3 pm Monday, January 29, 1979.

Courses: Full call — final brush up and lectures for February theory and Morse code examination.

Novice and beginners — introduction to radio and lectures on theory, introduction and Morse code practice, both at novice licence standard.

Fees: Adults — $29.00; ladies not attending lectures — $19.00; students age 11 years to secondary standard — $19.00; children 10 years and under — $12.00. Deposit $5.00 per person (non-refundable).

Bookings: Katoomba Weekend. PO Box 52, Asquith, NSW 2078. Please make cheques payable to Katoomba Weekend.

There is a limit to the number of persons that can be accommodated; bookings will be on the first in basis, so book early.

When booking list any call signs held and the level of instruction required.

A limited number of private rooms are available with preference given to family groups. Other accommodation is in dormitories. Bring own bed linen or sleeping bags; meals and everything else are supplied.

Any enquiries may be made to Sydney telephones — (02) 827 3589; 638 1687 or 47 3044 during evenings only.

VALE
TREVOR EVANS VK2NS

The many Australian and overseas friends of Trevor Evans, VK2NS, will be sad to hear of his death at Bathurst, NSW, on Sunday, 29th October, 1978.

Born around the turn of the century at Blaney, NSW, he became interested in radio communication at a very early age and in 1912 he was experimenting with a spark transmitter and coherer receiver. He was licenced as an amateur in 1923 and until the day of his death was actively engaged in the many facets of amateur radio. As an immaculate CW and phone operator his "fist" and operating procedure was world renowned and an inspiration to all.

Many years ago Trevor specialised in accurate frequency measurements and was one of the pioneers in hand grinding crystals, having supplied these to broadcasting stations.

In 1926, Trevor founded the Rag Chewers Club which functioned for many years to encourage and improve the standard of CW operation. He was member number 575 of the Old Old Timers Club and held the number one 50 years award.

In 1931, Trevor won the British Empire Radio Union's trophy in the in-

AMATEUR RADIO

augural contest which, in the presence of many of his associates in amateur radio, was presented to him in Sydney by the Lord Mayor, Alderman J. Jackson.

Apart from radio, Trevor had many hobbies. During the 1930s he became interested in dirt track motor cycling. He also was an expert photographer. Model making was another hobby at which he excelled, constructing miniature blast furnaces for smelting iron ore, steam driven locomotives, turbines and stationary engines, also hot air and suction gas engines.

Well known and respected by all who knew him, for 55 years Trevor upheld the principles of the amateur radio operators code in a manner which should be an example to us all.

To his wife and family is extended deepest sympathy.

TV CHANNELS 0 & 5A

Strong objections by the WIA, and amateur licencees in general, to members of the Australian Federal Parliament in relation to proposed expansion of TV channel 5A, has brought heartening results.

In an address, opening the WIA Queensland division 1978 annual convention in Brisbane on October 16-17, Mr David Jull, MP for Bowman, Qld, and secretary of the communications committee of Federal Parliament, made these comments, which were broadcast over WIA official stations —

". . . Congratulations to the number of members of your association indeed the community who approached members of parliament, who wrote to the Minister and to members of my committee, to express their concern and in fact formed themselves into a very satisfactory and very hard hitting lobby group.

"I am pleased to announce that the decision for channel 5A to be used in metropolitan areas has been completely shelved and won't happen. Furthermore, an investigation is now underway by the department to eliminate those areas that are using channel 5A for translator facilities in some of the TV country areas.

"I believe that if it had not been for pressure of members of your association throughout Australia the decision to go ahead with channel 5A would have gone ahead and we would have been in all sorts of troubles and got ourselves into a ridiculous situation, certainly internationally.

"An announcement was made on Thursday of the first of the moves as far as TV stations are concerned. As you probably know, the original idea was to transfer Channel 0 in Melbourne and Channel 0 in Brisbane to Channel 10 but this would have caused problems in areas like Traralgon in Victoria and Toowoomba in Queensland, because those areas are using Channel 10 and Channel 5A was seen as a very real alternative.

"However, on Friday it was announced that Channel 0 in Melbourne is already going to Channel 10 as soon as possible and I should think a similar announcement will be made here in Brisbane about the fate of Universal Telecasters as well. Both stations I understand are quite pleased about the change because that suits their network arrangements as well.

"I am sure that you are pleased with that news and once again congratulations for the work that has been done by your organisation."

Later in his address David Jull made these observations: " . . . and I think by the experience of Channel 5A you will probably realise as well, the amount of power and punch an organisation such as yours and your affiliated branches around Australia can have and, indeed, if there are any other areas of these particular operations that concern you, I would ask that you do submit your objections and so once again a concerted approach can be made to try to get some sensible and sane decisions to be made by the government.

RADIO CLUB NEWS

It is time again to plan your visit to the Central Coast of NSW for the Central Coast Amateur Radio Club's field day.

This will be held on Sunday, February

AMATEUR RADIO

18, 1979 at the Gosford Showground.

Amateurs, their families and friends, are invited to what has become the largest event associated with amateur radio in Australia.

Full program details next month.

GOLD COAST AMATEUR RADIO SOCIETY: An overall plan for a GCARS emergency network has been accepted by the Queensland police and State Emergency Service organisation who were very impressed with it.

All amateurs from Kingscliffe (Nth NSW) to Beenleigh along the Gold Coast areas will be notified of an emergency channel, whether they are GCARS members or not, and will be asked to participate in exercises.

It is anticipated that a separate search and rescue communication unit will be formed within the existing plan, to cater for minor emergencies.

Gold Coast visitors are invited to attend GCARS meetings, held every second Friday of the month at the State Education Centre, Cnr Laycock Street and Gold Coast Highway, Surfers Paradise.

WAGGA AMATEUR RADIO CLUB: Recently a large WIECN exercise was held by WARC members in conjunction with a Handicapped Persons Radio Appeal Day via the local broadcast station. WICEN's role entailed handling over 1000 messages during a 12 hour period.

A base was set up at the broadcast station centre and information was continuously passed to six WICEN mobile units strategically positioned throughout the city of Wagga. WICEN members helped to make the event most successful and, at the same time, provided the opportunity for members to handle high density traffic.

During the past six months, members of the Wagga Rescue Club otained and reconditioned a heavy duty 23 metre high radio tower for WICEN's HF and VHF antennas. The tower, combined with an excellent operating console and telephone, indicates the high level of liaison between the Wagga Rescue Club and WICEN. A similar level of liaison exists between WICEN and Regional Headquarters of the SES — with whom WICEN is heavily involved during river floods.

Anyone wishing to join the WARC 1979 training classes for the full call (AOCP) or novice (AONCP) licence are invited to write to the secretary WARC, PO Box 71, Kooringal, Wagga, NSW.

GEELONG AMATEUR RADIO CLUB: The "Sleepy Hollow" 10 metre award has been initiated by a group of novice licencees in Geelong. Sleepy Hollow is the local pet name for Geelong.

The basic award is a series of prints of Geelong in 1857. Two more prints in the series can be obtained by working the required number of contacts and applying for the Citizen and Overlander endorsements.

To obtain the basic award it is necessary to have five contacts with chapter members, two of which must be charter members.

The Citizen endorsement requires 15 contacts and four of these must be charter members. The Overlander endorsement requires 30 contacts and six of these must be charter members.

The chapter meets on 28.530MHz at 2300GMT and again two hours later on 28.480MHz.

Chapter awards manager is John Weston, VK3NRW, who can be contacted on 10 or 15 metres or via PO Box 520, Geelong, Vic. 3220.

ILLAWARRA AMATEUR RADIO SOCIETY: Insurance money to cover the loss and damage of moonbounce equipment and buildings at Dapto, NSW, has been paid. Quotes have been called for the removal and installation of the dish antenna at a new site.

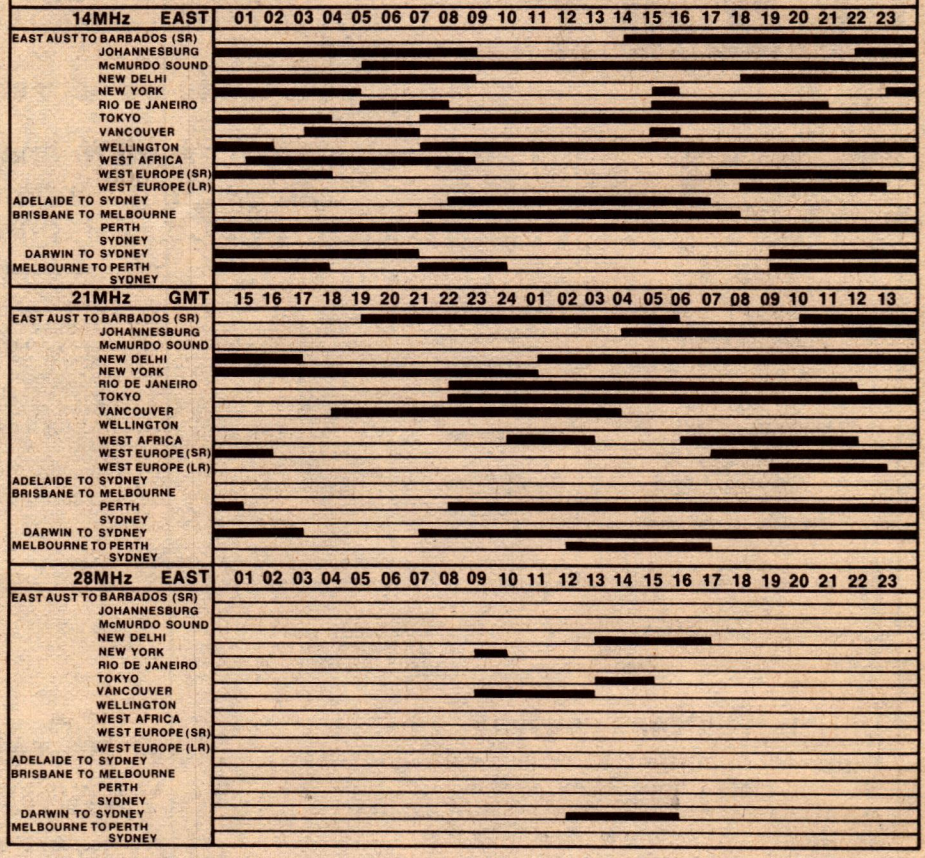
Details of a microstrip line type radiator as used in the Parkes radio telescope at 408MHz have been obtained. If the relocation of the antenna is successful a 432MHz version will be made as it will give better illumination of the dish than the crossed dipoles that have been used.

The moonbounce transmitter has been reassembled by Lyle Patison, VK2ALU and is being modified and checked.

Meetings of the IARS are held on the second Monday of each month at 7.30 pm in the Wollongong Town Hall meeting room. Visitors welcome.

IONOSPHERIC PREDICTIONS FOR JANUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 1.79



YAESU aerial tuners with power & SWR meters

By use of a tuning unit, available as an accessory, the output impedance of most high frequency transceivers can be accurately matched irrespective of the type of antenna used.

Two YAESU antenna tuners, models FC-301 and FC-901, were tested recently. These are designed as matching accessories for the Yaesu FT-301 and FT-901 transceivers. However, both are suitable for use with other types.

Both use virtually the same circuit, the only electrical difference being in the value of one minor component. The major difference is physical, the FC-301 being smaller than the FC-901, and having a recessed front panel.

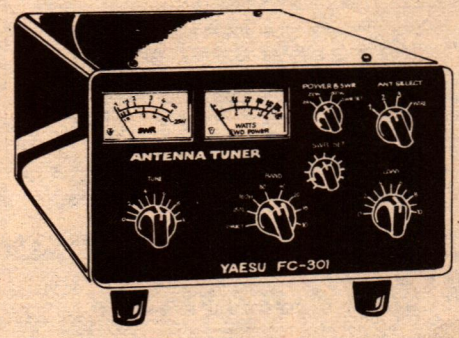
Both units have the same front panel layout, consisting of two meters and six control knobs. One meter displays SWR on two ranges, one for power outputs up to 25W and one for powers above 25W. The second meter indicates forward power on three ranges; 25W, 250W, and 500W, and also carries an "SWR Set" mark. The six controls are; Power & SWR, Antenna Select, SWR Set, Tune, Band, and Load.

The Antenna Select switch has four positions; any one of three coaxial antenna connectors, or a single wire antenna terminal, all on the back panel. The Band Select switch has eight positions; direct, 160L, 160H, 80, 40, 20, 15 and 10 (metres). The "L" and "H" indicate the lower and higher sections of the 160 metre band. The direct position allows the antenna to be fed direct to the transceiver, bypassing the tuning unit but retaining the SWR and power metering facilities.

Basically, the operation is that the output of the transceiver is fed through an SWR and power bridge to the junction of two 300pF ganged variable capacitors, in parallel with an inductance which is tapped for each band setting, and then coupled to the antenna through a variable 430pF (loading) capacitor.

Checks were made on 3.5MHz and 7MHz using halfwave dipole antennas, and on 14MHz, 21MHz and 28MHz using a three element Yagi tri-band antenna. All used coaxial feeeders and had good centre-band SWR figures. Using the tuning unit it was possible improve this to a 1 to 1 SWR on any portion of any band.

A more exacting test involved a single wire, inverted "V" aerial, 53 metres long, with an apex 15 metres high. The tuning unit enabled the transceiver to be loaded to give close to



maximum output on all bands, including 1.8MHz, on which some good contacts were made. Several shorter random lengths of wire were fed and loaded for 7MHz and higher bands.

The most severe test involved a 2.5 metre long, centre loaded whip antenna originally tuned for mobile operation when mounted on the rear bumper bar of a station sedan vehicle. Used as a vertical antenna about two metres above ground it presented an extremely high SWR to the transceiver. However, coupled through the tuning unit it was a very effective antenna, producing a readability five, strength six report from Helsinki, in Finland, on 14MHz.

Yes, the units achieved their design purpose without any difficult or critical adjustments and are considered quite effective. They are of solid construction and the components appear to be of good quality.

Although not affecting the performance of the units, here are two suggestions for worthwhile improvements. It seems that, with digital readout tuning now almost commonplace, and the emphasis on frequency allocations, the legend associated with control knobs and switches should read lower band edge frequency rather than metre bands.

Also desirable is a facility to enable all four antenna connections to be positively earthed when the tuning unit is not in use. This would provide protection from lightning strikes or the build-up of high static charges, particularly for solid state front end devices, and elimite the need to disconnect antennas as a safety precaution when the station is unattended.

The units are supplied with an eight page manual containing instructions, circuit diagram, and a photograph of the interior layout. There is also a coaxial cable connector to connect the tuning unit to the transceiver.

A section in the manual strongly recommends the procedure to be followed when matching antennas. It also points out that, although the correct impedance will be presented to the output of the transmitter, the tuning unit will have no effect on losses due to miss matches at the antenna or feeder line losses between the tuning unit and antenna.

The unis under review were supplied by Dick Smith Electronics Pty Ltd. (PJH-VK2APQ)

AMATEUR BALUN FROM SCALAR DISTRIBUTORS

Scalar Distributors Pty Ltd announce the availability of a substantially made commercial balun suitable for amateur use on all bands from 2MHz to 40MHz. Called the "W2AU Balun", it is manufactured by the Microwave Filter Co Inc, of U.S.A.

The balun is designed to replace the centre insulator in a dipole antenna. It is fitted with three stainless steel eyelets, two of which are used to terminate the two halves of the antenna. The third eyelet, at the top of the package, can be used to support the balun, and the aerial, for inverted "V" configurations.

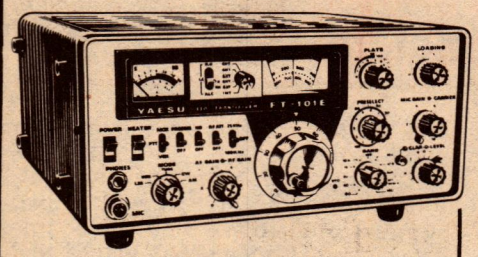
As well as the balun, the unit contains a lightning arrester to assist the discharge of lightning and static electricity. It is fitted with an SO239 socket on the underside, is weatherproofed, and designed to withstand a 290kg (650lb) antenna pull. It weights only 184g (6.5oz), and measures 38mm (1.5in) in diamter and 150mm (6in) long.

Two versions of the balun are available. The model K1:1 gives a 1 to 1 ratio and is designed to couple 50 or 75 ohm coax to a 50 or 75 ohm balanced load. The model K4:1 gives a 4 to 1 ratio and is designed to couple 50 or 75 ohm coax to 200 or 300 ohm balanced loads. Power rating is 1kW.

Price of either model is $34.50, including sales tax. Further details from Scalar Distributors Pty Ltd, 18 Shelly Avenue, Kilsyth, Victoria, 3137, or 20 The Strand, Penshurst, NSW 2222.

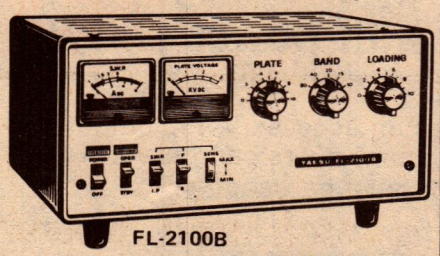
NEW YEAR TIME IS NEW GEAR TIME

Don't dilly dally pally – the longer you put it off the more it'll cost you



FT-101E

World's most popular transceiver! Get yours today, they'll never be cheaper!
Cat. D-2860...**$975.00** (or from $6.75 weekly)



FL-2100B

Incredible matching linear amp. Full 1.2kW – really stirs the DX. Team it with a 101E or 901D for a real signal.
Cat D-2546...**$585.00** (or from $4.00 weekly)

Did you make a new year's resolution to work VHF – DX? Here's your chance!

OSCARTRAK

Take the hassle out of satellite work. Complete kit for both OSCAR 7 and 8 – full instructions.

Cat. K-3480

$9.50

****
EXCLUSIVE TO DICK SMITH
****

Dick Smith's Oscar Tables
Full basic details on OSCAR, prediction tables, standard orbits and tracking details. The most comprehensive brochure ever assembled on OSCAR. Totally practical.
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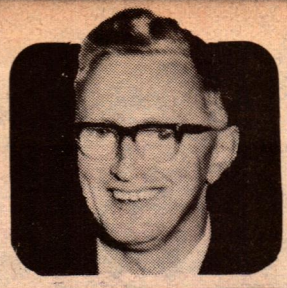
SHORTWAVE SCENE



by Arthur Cushen, MBE

More frequencies and restricted power predicted

Various countries are putting forward ideas to be presented at the World Administration Radio Conference (WARC), to be held in Geneva this year. The Conference will determine the allocation and control of frequencies, including the short-wave bands.

There have already been proposals to increase the size of many of the existing short-wave bands to allow for more frequencies for international broadcasting. One idea, which has not been approved by third world countries, is the use of the present 60-metre tropical band for international broadcasting. The use of this band would be a point of concern for short-wave listeners world-wide, as the lower-powered African and Latin American stations could be lost if high-powered international stations used the frequencies between 4750 and 5060kHz.

At the same time there have been moves afoot to give international stations a maximum power output so that super-powered transmitters on short-wave would be banned. Radio Canada is putting forward the suggestion that 250kW be the maximum power allowed for international broadcasting, as they believe that this power, with its limitations, would force stations to improve their aerial systems and give a better beam and concentrated signal on target areas. This would of course reduce interference to other transmissions, not only to those adjacent to the frequency but also those using the same channel.

Radio listeners in Australia and New Zealand have been making submissions to the various government departments that will be attending the Geneva Conference, and it is known that radio amateurs are also concerned of the possibility of in-roads into the frequencies they have been allocated in the past.

The frequency plan put forward by most countries seems to be consistent with the idea that all the present short-wave bands should be increased to double their present size, and a new frequency band be opened around 13600-14000kHz. The expansion of the bands would not include the present 13 and 11-metre bands, which appear to be sufficient for the frequencies being used during the maximum sunspot period.

BROADCASTS TO AUSTRALIA

Over 30 countries have special transmissions to Australia every day, and this short summary only includes information about stations which have changed frequency for our summer reception period. During our summer evenings, signals on the higher frequencies reach their peak. Many stations are now using the 16 and 13-metre bands to serve this area more effectively during the period of high sunspot activity.

AUSTRIA: The Austrian Radio at Vienna has three transmissions to this area: 0400-0600GMT on 17770kHz, 0700-0900 on 17720kHz and 0900-1300 on 21715kHz. Additional coverage is noted at 0600GMT on 21470 and 21555kHz, and both these signals are well received at the moment. The English broadcasts are at 0430 and 0830, and the 30 minute program is called "Report from Austria".

CANADA: Radio Canada provides a secondary coverage to Australia in several transmissions. The broadcast 2130-2200GMT on 15150, 15325 and 17820kHz has been well received, with the additional frequency of 11945kHz providing fair reception. During our afternoons the 30 minute program at 0300GMT is noted on 9535 and 11845kHz, while it is repeated at 0400GMT on 9535kHz.

DENMARK: Radio Denmark has a daily transmission to Australia 0900-1000GMT on 15165kHz. The station is now using this frequency for all its broadcasts, having dropped the experimental transmissions on 6175 and 9710kHz.

GREECE: Athens continues to be well received with its program of Greek and English 0900-0905GMT on 9655 and 15160kHz. Transmission for our morning reception is received 2100-2150GMT on 6140, 9655 and 9760kHz. A further transmission in Greek is broadcast 2200-2250GMT on 9655kHz.

GERMANY: Deutsche Welle, in its English broadcast to Australia, has added the new frequency of 21680kHz for the transmission 0930-1030GMT. The other frequencies carrying this program are 9650, 11850, 15275, 17780, 17800 and 21540 kHz. The new channel of 21680kHz is being well received. The morning broadcast in English 2100-2200 is on two frequencies: 7130 and 9765kHz.

ISRAEL: Jerusalem uses several frequencies for our afternoon reception in English 0500-0515, followed by a broadcast in French to 0530GMT. Three frequencies — 11655, 17855 and 21495kHz — are used, with the former being the best received. The latest schedule from the Israel Broadcasting Authority gives details of two further English broadcasts: 1200-1230GMT on 11655, 15405, 15530, 17685 and 21495kHz; 2000-2030 on 9009, 9425, 9815, 11655 and 17685kHz.

SWEDEN: Radio Sweden is now using 21690kHz for its English broadcast to Australia and New Zealand 1100-1130GMT. This frequency replaces 15125kHz. The single sideband transmission to this area, which is a relay of the Swedish home program 0500-0830GMT, continues to be received on 21550kHz.

SWITZERLAND: Swiss Radio International is the new name for the overseas service of the Swiss Broadcasting Corporation, Berne. Two English transmissions are broadcast to Australia each day. The broadcasts are 0700-0730 and 0900-0930GMT on 9560, 11780, 15305 and 21520kHz. The balance of the transmission includes Italian at

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time it is necessary to add one hour.

SHORTWAVE SCENE

0730, French 0800 and German 0830GMT.

USA: The Voice of America has two daily transmissions to the South Pacific: from 1100-1400GMT on 5955 and 9730kHz; and from 2200-2400GMT on 15290, 17820, 21610 and 26095kHz.

USSR: The Radio Moscow World Service has now been extended to 19 hours a day from 0400 to 2300GMT. The balance of the day is devoted to a special transmission to North America. English news and commentary is broadcast every hour on the hour, with news headlines on the half hour.

VATICAN: The Vatican Radio is using 15120kHz for our summer reception period and this frequency carries the English broadcast 2210-2225GMT. Two other frequencies — 9615 and 11705kHz — also carry this special transmission to Australia.

AFRICAN SIGNALS

Signals from Africa in the 60-metre band are best received at dawn during September and March, and these signals should again be heard in about a month's time. This review is a listing of observations at our own location, together with items provided by Peter Bunn of Melbourne in "DX Time," on Radio Australia.

MAURITIUS: Forest Side is noted on 4850kHz, closing at 1830GMT. The station has also been noted with "Saturday Special" in English, closing at 1900GMT, the normal sign-off time for Saturdays.

SEYCHELLES: The Far East Broadcasting Association has been heard on 15405kHz with a program in Farsi to 0345GMT and then a program in Arabic.

SWAZILAND: Trans World Radio has been noted on two frequencies with a Portuguese program on 4790kHz at 1830GMT and a gospel program in German on 4760kHz at the same time.

NEW VOA OUTLETS

The Voice of America has added another frequency to the 11-metre band with a broadcast to the Far East on 25990kHz from 2200GMT. The broadcast to Australia and New Zealand in English has also undergone a frequency change. The transmissions are now 1100-1400GMT on 5955 and 9730kHz from Dixon, 2200-2400GMT on 21610 and 26095kHz from Dixon, and 15290 and 17820kHz from the Philippines relay base.

The latest VOA schedule also shows that the 11-metre band is being used by the Greenville transmitter on 26040kHz from 1600-2000GMT. This transmission is beamed to Africa using the power of 50kW. At 1100GMT, the VOA is using some new channels to the Far East, including 15245kHz 1100-1330GMT, while 17840kHz is used 2200-2400GMT from the Delano transmitters in California.

LISTENING BRIEFS

ASIA

ISRAEL: Jerusalem, in its special transmission to Australia with English 0500-0515GMT, now uses three frequencies: 11655, 17855 and 21495kHz.

PAKISTAN: Radio Pakistan has recently introduced a short news bulletin in English at 1005GMT as part of their World Service to Europe. The transmission is carried in Urdu for the rest of the program 0700-1100GMT on 17665 and 21625kHz. A full news bulletin in English is broadcast at 1100GMT on the same frequencies. The transmission to Europe, heard during our mornings 1915-2145GMT, is received on 9465 and 11677kHz.

SAUDI ARABIA: The Riyadh transmitter has been observed on 15060kHz by John Mainland of Wellington, NZ. Broadcasts are in Arabic and noted at 0730 and 1800GMT. This frequency is also used by Radio Peking, while some sideband interference has been noted from these two stations to the BBC on 15070kHz.

Letters to the editor

WIA and WARC '79

One of the main functions of the Wireless Institute of Australia, according to many people, is to represent amateur radio nationally and internationally. This is quite apart from the various membership services, including the monthly journal, available to members.

The WIA does represent Australian amateur radio. Officers of the Institute have spent countless hours of their own time negotiating better conditions for amateurs with the Posts & Telecommunications Department. Unfortunately this is not enough. Why?

Amateur radio in Australia is one of the many services governed by the Wireless Telegraphy Act and Regulations. A very large number of the Regulations stem from international radio regulations adopted by the member countries of the International Telecommunications Union. Australia is one of the 154 member countries of the ITU.

About once in every 20 years the ITU holds a general administrative conference to revise the international radio regulations relating to all the world-wide allocations in the frequency spectrum and various associated matters. The next conference, WARC '79, is to be held in Geneva in 1979.

At WARC'59, the amateurs of Australia were so concerned about the amateur service that, through the WIA, they lobbied for and were successful in obtaining amateur observer status on the Australian delegation. This amateur was the late John Moyle, VK2JU. His attendance highlighted the belief that amateurs must always be present at the vitally important conferences and, of course, the International Amateur Radio Union (of which Australia through the WIA is a member) is best geared to cover the general interests of amateurs. His report also highlighted the need for an amateur to be part of the Australian delegation and consequently the WIA established a fund shortly afterwards to enable this amateur participation to occur in the future.

WARC '79 is a 10 week conference. Leading up to this, each country's Government must make plans and prepare a brief for the delegation. Australia has been involved with this for two years and the amateur service is one of the Committees forming part of the Planning Group. As part of the preparations for WARC '79 a meeting of Governments' technical experts (CCIR) will occur in Geneva later this year. Australia will participate.

Ministerial assurances have been given that an amateur representative will be included in the Australian delegations.

Simultaneously a tremendous amount of preparatory work has been carried out by the IARU. Once again Australia has been involved through the WIA. This preparatory work is aimed at amateurs throughout the world influencing their Governments, through amateur societies, to ensure as uniform and strong a voice as possible is heard from amateur radio. This is vital both now and throughout WARC '79 to ensure that commercial and other interests do not take away any of our frequencies and privileges without the strongest possible fight.

It is sadly true that all these efforts cost money. Members of the WIA have met the brunt of the financial burden but in comparison with America, Japan and Europe we are comparatively small in numbers.

Additional funds are essential if the radio amateurs of Australia are to assure themselves that no losses occur to our amateur service by default. Amateurs and others can help in either or both of two ways: By sending a donation to the ITU fund, and/or by joinging the WIA.

Donations should be sent by crossed cheque, money order or postal order made out to "W.I.A." and sent to P.O. Box 150, Toorak, Victoria 3142.

P. B. Dodd, Secretary,
Wireless Institute of Australia,
Toorak, Victoria.

Film striping

In the October issue of Electronics Australia on pages 50 & 51 there appears an article "Electronic eraser for mag film and tape". In the bottom right corner of page 51 a little item appears i.e., "Where can I get film striped".

We are manufacturers of film striping equipment and are in the film striping business. We are the original and the major company in the film striper manufacturing business and also the major film stripers in Australia. We cater for film laboratories, camera stores throughout Australia, government departments, schools, industry and the public. Our charges are in accordance.

I thought I would like to bring the foregoing to your attention as there are many people in Australia and the Pacific and in overseas countries whom we cater for in addition to those residing in Sydney and surrounds and in NSW country towns who require a service they can trust and require the best in performance.

Our prices are (retail): Std & Super 8mm single track: 3 cents per foot with a minimum of 100 feet. Cost of balance stripe is additional. We stripe both double and single perforated 16mm film. We also lay in stripe on 8mm and 16mm prints. We will be only too happy to supply details to those interested.

I trust the above is of interest to you and your readers.

E. K. De Cean (Gp Capt RAAF Rtd)
3-S Sound Stripe Services
10 Glenwood Avenue
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Apprentices

I read with interest the article in your September issue concerning the apprentice at station 3DB, and decided to let you know that STW 9/6KY Perth also has an apprentice scheme in operation. In 1978 we had two apprentices in Stage 4 and two apprentices in Stage 3, and we intend to continue again this year with a further apprentices. Our current Stage 4 apprentices will complete their formal training at the end of 1979 and their efforts until now are a credit to them.

The apprentices attend the Mount Lawley Technical College and are training with the Radio and TV Servicing Trades. Our recruiting has been by selection from the Pre-apprenticeship Courses held at that college.

I hope that this is of interest to you and your readers.

Bob Penno
Asst Chief Engineers, STW9
Tuart Hill, WA

New Products

Trio CS-1570 Dual Trace 30MHz Oscilloscope

While it looks very similar to other dual trace oscilloscopes in the Trio range, the top-of-the-line CS-1570 is a considerably upgraded and more complex unit. The CS-1570 has a bandwidth from dc to 30MHz and a maximum sensitivity of 5mV/cm.

Dimensions of the CS-1570 are 277 x 204 x 440mm (W x H x D) and mass is 8.5kg. The unit has a large carrying handle which also functions as a tilting bail for convenient viewing.

Vertical deflection sensitivity is adjustable in ten ranges in a 1-2-5 sequence from 5mV/cm to 5V/cm, with continuous variation being available via a small knob concentric with each channel's attenuator. Input impedance is one megohm shunted by 22 picofarads. Rise-time of the vertical deflection amplifiers is 11.7 nanoseconds with overshoot less than 3%.

Maximum input signal to either channel is 600 volts peak-peak or 300V (dc + ac peak). Each channel input is controlled by a three-position switch which provides dc or ac coupling or grounds the input. Crosstalk between channels is quoted as 66dB at 1kHz, although the test conditions are not stated.

Twenty timebase ranges, in a 1-2-5 sequence, give sweep speeds ranging from 0.5 seconds to 0.2 microseconds per division (one division equals one centimetre). Continuous adjustment is again provided in the form of a concentric vernier knob.

As with other Trio oscilloscopes, the timebase can be switched off to give X-Y operation, with the CH2 signal being the horizontal component.

Comprehensive timebase triggering facilities are provided on the CS-1570 with four switches and one knob. Triggering can be on the positive or negative slope of waveforms and low or high frequency filtering can be employed. The timebase can be triggered from channel 1 or channel 2.

There are switches to select the display mode, which can be either channel 1 or 2 or both (dual trace) or the sum or difference of both channels. The "Add" mode is particularly handy for checking phase differences (or propagation times) of two different waveforms. In fact, it is the only method of accurate comparison of waveforms at fast sweep speeds, because the CS-1570 cannot be switched to the alternate trace mode at the whim of the user. The unit changes automatically from chopped trace to alternate trace for sweep speeds above (and including) 0.5 milliseconds per division.

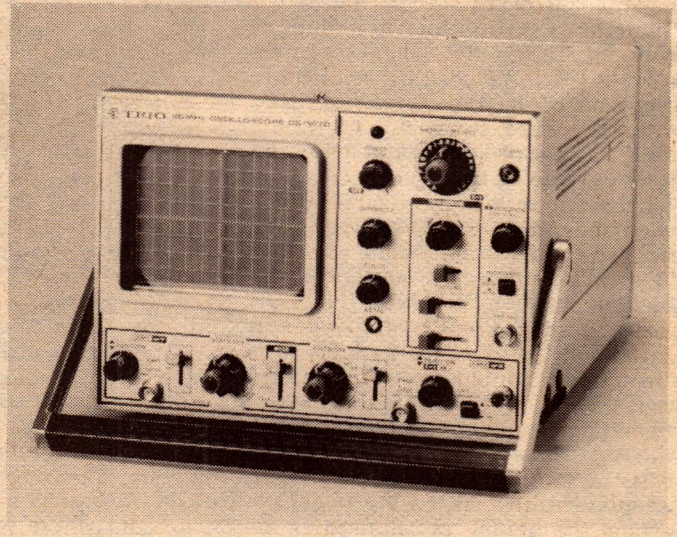
For calibration of the sweep speed and vertical amplifier sensitivity a reference 1kHz 0.5V peak-peak waveform is provided. The amplitude of the waveform is accurate to within ±1% while the frequency accuracy is ±3%.

The oscilloscope employs a 130mm diameter tube with a mesh type PDA (post deflection acceleration) electrode. The accelerating potential is 4kV overall, which is provided by a high frequency inverter. Apart from the tube, all the circuitry is solid state, with 10 ICs and a large number of discrete semiconductors.

A comprehensive manual is supplied with the instrument. Not only does it include full details of the circuitry and its adjustment, but it also has a large section of general test methods and applications for the oscilloscope.

Optional accessories for the CS-1570 oscilloscope are a pair of PC-28 probes. These may be switched from 10:1 attenuation to direct connection by disconnecting the probe tip and reinserting after rotating through 180 degrees. Input impedance in the direct mode is one megohm shunted by 120pF or less, while in the 10:1 mode it is 10 megohms shunted by 18pF or less. Maximum input is 500V peak-peak.

We found the oscilloscope easy to use and the sync and triggering facilities particularly good. The tube gives bright and sharp displays, although by comparison with a competing model (of lesser bandwidth) the display focus and brightness was not as good with pulse waveforms, which require very fast trace writing speeds.



The Trio CS-1570 features comprehensive sync and triggering facilities and has a mesh-type PDA tube. The vertical channels have delay lines to enable the rise-times of pulses to be viewed.

The probes are a little awkward to use in practice and we have a preference for those that are switchable between direct and 10:1 mode.

Our overall impression of the CS-1570 is that for the facilities it offers, it represents good value for money. Further information can be obtained from the distributors for Trio test equipment, Parameters Pty Ltd, 68 Alexander Street, Crows Nest, NSW 2065 (L.D.S.)

B&K Model E-200D RF Signal Generator

This middle of the road RF signal generator fills a gap between the very expensive laboratory models and those which are little more than toys. The B&K Model E-200D should meet a need for a quality instrument at a reasonable price.

The B & K Model E-200D RF Signal Generator promises to fill a gap between the top line laboratory-grade signal generators and the very simple ones. By "simple" we mean those which are basically a calibrated oscillator, with usually only a token attenuator which could not be seriously calibrated for output.

The E-200D is housed in a neat metal cabinet with ligh khaki painted ends and bottom. An L-shaped piece covered with black vinyl is removable and forms the top and back panels. The front panel is finished in matt black with white engraving. Dimensions are 322mm wide x 180mm high x 170mm deep, plus knobs. Shipping weight is given as approximately 14 pounds, which is a bit less than 6.5kg.

Frequency coverage of 100kHz to 54MHz is achieved on fundamental, in five bands. These are 100kHz to 370kHz, 370kHz to 1400kHz, 1.4MHz to 5.1MHz, 5.1MHz to 16MHz, and 16MHz to 54MHz. Two extra ranges are added covering 32MHz to 108MHz, using the second harmonic, and 64MHz to 216MHz, using the fourth harmonic. Frequency calibration checks can be made at 1MHz and 100kHz points from a crystal oscillator. The heterodyne principle is used, the beat note coming from a small loudspeaker mounted behind the main dial scale.

RF output attenuation is achieved by seven slider switches, five giving 20dB each, one 10dB and one 6dB, giving 96 dB in all. Further fine attenuation is available with a rotary attenuator, calibrations being read off the meter up to 10dB. RF output levels of down to 0.5uV, corresponding to —106dB, and up to 126mV, corresponding to +2dB, are available when properly terminated with the cable provided. In practice, these levels can be exceeded by a useful amount in each direction without the benefit of calibration.

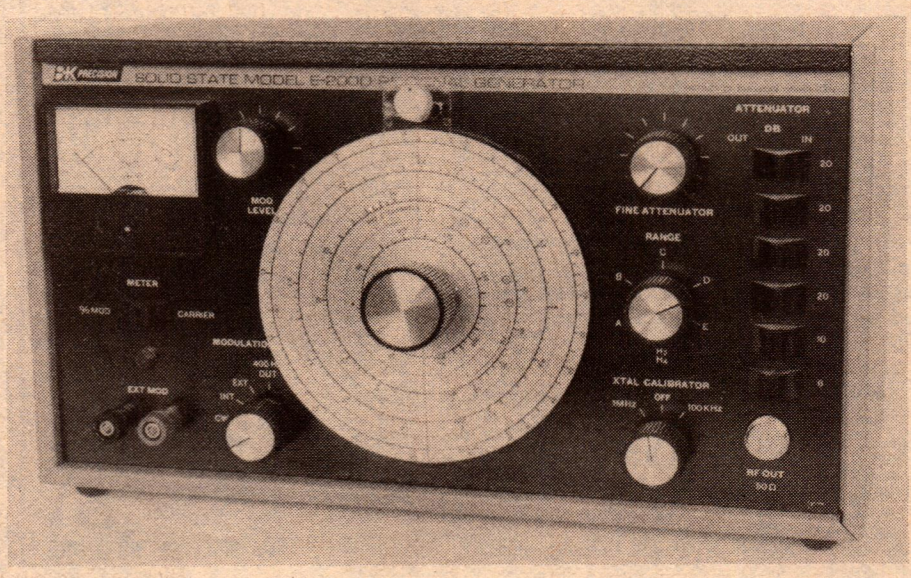
The carrier generated may be used unmodulated but provision is made to amplitude modulate at approximately 400Hz with an internal audio oscillator. The RF generated may also be modulated from an external source, while the output of the 400Hz internal audio is also accessible from the front panel. Modulation depth is adjustable, with up t0 50% indicated on the meter. Modulation up to 100% is available, but external means would be needed to measure values above 50%.

Frequency accuracy is quoted as ±1.5% of the highest frequency on any given band, usable to ±0.1% with crystal calibrator. The dial scale cursor is adjustable to enable accurate frequency setting at any calibrator point.

Calibrated RF output accuracy is quoted as ±1dB from 100kHz to 54MHz. No figures are given for the two higher ranges as harmonics are used and calibrations would not be valid.

A large metal dial 128mm in diameter carries the seven scales, alternately in black and red. Although the seven scales occupy most of the available space, it is uncluttered and easy to read. A 6:1 planetary drive between the tuning knob and the dial gives a smooth action and allows easy and accurate settings.

An instruction manual is included which gives the circuit of the unit, together with a full description. Operating instructions are clearly set out and easy to follow. Also, suggested methods of using the generator are given, including methods of receiver alignment where such is not available for the particular receiver to be aligned. Suggestions are also given for the alignment of FM receivers and television receivers.



I found the instrument easy and convenient to use, but some of the mechanical aspects seem to have suffered due to cost cutting. The knobs are of the spring-loaded push-on type which fit a standard half-flat shaft. These do the job but they are inclined to be a bit floppy when compared with knobs which are secured with a good grub screw. Also, the range switch and fine attenuator shafts originate from internal sub-assemblies. These shafts pass through clearance holes in the front panel and this results in quite floppy controls.

To cure this problem it would be necessary to fit a second bush to the front panel, as well as fitting a flexible coupling between the sub-assembly and the front panel. This would add a little to the cost but I think that it would be worthwhile.

Still on the subject of mechanics, two other improvements would seem to me to be worth while. For ease of operation it would be nice to have some sort of prop so that the front panel can be inclined for better access to the controls. A carrying handle would also be a welcome addition. Perhaps these latter points may be a matter of individual choice; to be sure they do not affect the basic performance of the instrument.

Having made a check on the question of RF leakage, with the facilities available, I was impressed with the performance of the attenuators. It may be that higher priced units would be somewhat better down in the sub-microvolt region, but I am of the opinion that for most practical purposes, the readings could be relied upon.

To sum up, at the price of $345 including sales tax and $299 without sales tax, this should be a worthwhile generator for professional and amatuer use where the ultimate is not required.

The E-200D was submitted for review by B&K distributors Paramaters Pty Ltd, 68 Alexander Street, Crows Nest, NSW 2065. Further information may be obtained from the above address, or by phone on 439 3288 in Sydney, or 90 7444 in Melbourne. (ILP).

New Products

LCD calculators

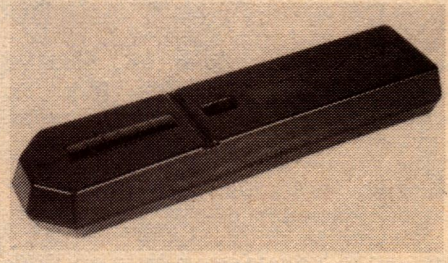
A new series of advanced pocket calculators featuring liquid-crystal displays, compact size and long battery life, has been released by Toshiba Australia Pty Ltd. They cover the needs of a wide variety of users from students, housewives and office staff up to business executives and scientists.

Smallest in the range are the slim-line Model LC-850M and the thin credit-size Model LC-581. Battery life on these is 2,000 hours continuous operation. Two other models incorporate digital watches with an alarm; one of these has a calendar and stopwatch facility as well.

The scientific calculator is ideal for engineers, mathematicians and advanced students. It offers 39 functions, and a 12-digit readout.

For the business executive, the electronic "brain" model includes 30 independent alphanumeric memories for names, dates, telephone numbers and similar constantly-used data.

AC wiring detector



Instantaneous non-contact indication of AC mains wiring is provided by the E-Z Scan Detector, a hand held battery powered device. Indication is via six LEDs, the number lit indicating the proximity of the wiring. Typical detection range is 20cm for 240V AC wiring, allowing detection of domestic wiring in walls, etc. It can also be used to find breaks in appliance cords and buried radiant heaters. From University Graham Instruments and most leading wholesalers.

New Products

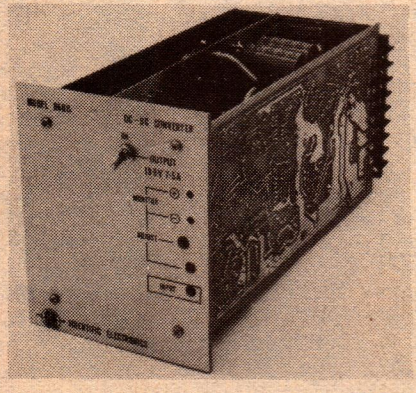
153cm screen TV

National Panasonic has released "Cinema-Vision", a compact one-piece projection colour TV system with a 153cm diagonal screen, UHF/VHF tuner and remote control. The projection system uses three tubes and a fold-out mirror, to give a picture three times brighter than a movie theatre image.

The CinemaVision comes complete with a 26-function infra-red remote control. It also has the ability to replay video tapes using either PAL or NTSC formats.

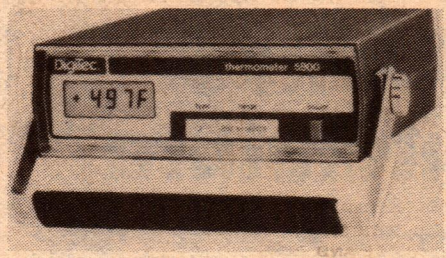
Enquiries to National Panasonic (Australia) Pty Ltd, PO Box 278, Kensington, NSW 2033, or National dealers.

DC-DC converter



The latest DC-DC converter in Scientific Electronics' range has all of the features of the existing 96D model, but now provides two independent and isolated output rails each capable of delivering 60W. The new model 96DB will operate over a wide DC input voltage range without changing any voltage links or taps. It has high efficiency, good regulation, overload and short-circuit protection. Further information from Scientific Electronics, 48 Barry St, Bayswater, Victoria 3153.

Digital thermometer



The latest additions to the DigiTec range of portable digital thermometers are the 5900 series, which offer thermocouple and RTD sensors, readout in either Celsius or Fahrenheit, and either LCD or LED display. Resolution of the series is 1 degree C or F. Optional analog output is available on all models, to allow strip chart recording of temperature trends.

Models are available offering compatibility with J, T, E or K type thermocouples, or PT100 platinum sensors.

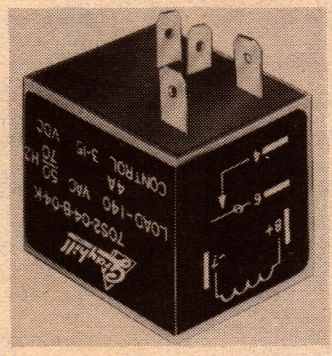
For further information contact NIC Instrument Co, Matthews Avenue, Airport West, Victoria 3042.

Power opto-coupler

ITT (MTI Division) has released a new opto-coupler, the COP-008, designed for power switching in such applications as machine tool controls, computer peripherals, heating controls and lamp drivers. The device can perform zero-voltage switching and is capable of controlling up to 8A in 380V circuits.

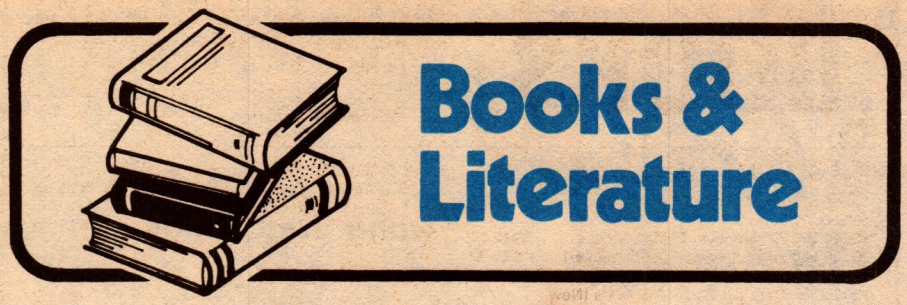
Available from Instant Component Service, which has branches in most states.

Solid state relay



The Grayhill 4 amp Mini Cube solid state relay is now available with terminations compatible with standard relay sockets, allowing direct plug-in interchangeability. The solid state relay measures 25 x 30 x 25mm and switches from 0.1 to 4A at 120V or 240V AC. No additional heatsinking is required for operation at rated loading.

Further details from Acme Engineering Co, 2-18 Canterbury Rd, Kilsyth, Victoria.



Books & Literature

New ARRL handbook

THE RADIO AMATEUR'S HANDBOOK, by the Headquarters Staff of the American Radio Relay League, Fifty Sixth Edition, 1979. Soft covers, 208 x 275mm, 538pp, many diagrams and pictures.

The latest yearly edition of the "Handbook" has arrived somewhat earlier than usual. And that's not all. It comes in a new format, with somewhat larger pages, having three columns instead of two. The new format is in keeping with that adopted for QST since about January, 1976. Using it has meant that the entire book has been laid out anew. Also much of the text has been revised or rewritten.

Other changes involve some rearrangement of the chapter subjects. The chapter on Amplitude Modulation and Double-Sideband Phone has been dropped and in its place a chapter on the new technique of Narrow-Band Voice Modulation has been added. This new chapter gives a good idea of this new breakthrough method, which promises to conserve bandwidth and so allow about twice the number of channels compared with the now normal SSB mode.

Another change is a negative one, in that the popular chapter listing vacuum tubes and semiconductors has been dropped. Presumably the reason for this would be to prevent the new handbook from becoming larger than the publishers wished. Also, it could be reasonably assumed that the publishers took the view that the information was already available quite readily from other sources.

Along with the many other changes to the handbook, the page numbering has been changed, from starightforward numbering to the system where each page is identified by the chapter number and the page number of that chapter. This latter system can have some advantages and I found it quite acceptable and convenient to use.

The larger format makes the book easier to handle and due to the fact that this format is more efficient, the publishers have wisely adopted a slightly larger type face. This naturally makes it easier to read. In the copy which I had for review, there were a couple of large ink blotches, one each on pages 7-16 and 6-44. But this was an early copy from a preliminary run, and hopefully we can expect that this fault will be rectified for copies coming off the press later on.

For readers not familiar with the chapter headings to be expected from this ARRL publication, here is a list. 1. Amateur Radio; 2. Electrical Laws and Circuits; 3. Radio Design Technique and Language; 4. Solid-State Fundamentals; 5. AC Operated Power Supplies; 6. HF-Transmitting; 8. Receiving Systems; 9. VHF and UHF Receiving Techniques; 10.Mobile, Portable and Emergency Equipment; 11. Code Transmission; 12. Single-Sideband Transmission; 13. Frequency Modulation and Repeaters; 14. Narrow-Band Voice Modulation; 15. Interference with other Services; 16. Test Equipment and Measurements; 17. Construction Practices and Data Tables; 18. Wave Propagation; 19. Transmission Lines; 20. Antennas for High Frequency; 21. VHF and UHF Antennas; 22. Operating a Station.

If you do not have a recent copy of the ARRL Handbook, then this new edition is a must. If on the other hand, you do have a recent copy, then you may like to have a look before you invest in this one.

Our review copy came from Dick Smith Electronics. They quote the price as $16.95 and say that copies should be available about the middle of January. Copies should also be available from other technical booksellers. (I.L.P.)

Waveform generator

110 WAVEFORM GENERATOR PROJECTS For The Home Constructor, by R. M. Marston. Stiff paper covers, 136 pages 217mm x 138mm, illustrated mainly by circuits. Published 1978 by Newnes Technical Books, London. Price in Australia $8.50.

Before the advent of solid-state devices, an author would have been hard put to it indeed to find anything like this number of variations on the one theme. But how different things are now.

In this book, R. M. Marston offers 13 pages of basic sine wave generators, with about as many circuits, 40 pages of triangle, ramp and sawtooth generators, followed by 11 pages of multi-waveform generators.

Then follows a chapter on special waveform generators, another on waveform modulation and two appendices: one showing integrated circuit connections and the other charts to extend the usefulness of the basic circuits.

Designed around transistors and ICs, the various designs have all been checked out, according to the author, and should therefore perform for anyone capable of working from a schematic and a brief circuit explanation. In fact, it looks like a good one for the experimenter who enjoys lashing up and checking out circuit ideas.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. Tel. (02) 412 3444. (W.N.W.)

Drawing text

ELECTRICAL AND ELECTRONIC ENGINEERING DRAWING by T. Baitch. Published by McGraw-Hill Pty Ltd, Roseville East, NSW. Hard covers, 277 pages 215mm x 185mm, illustrated by diagrams and photographs.

Theodore Baitch is an electrical design engineer with lecturing experience at the Sydney technical College and the New South Wales Institute of Technology. He has written this book primarily as a text book for the subject, "Drawing", in electrical and electronic certificate, diploma and degree courses.

The International System of Units (SI) is used throughout the book and the drafting standards used are the Australian Standards AS1100, AS1102 and AS1103 as well as the International Electrotechnical Commission (IEC) Standards 113 and 117.

The book is structured into 60 chapters and deals with all forms of electrical and electronic drafting, schematic diagrams, wiring diagrams, printed circuit boards, electrical reticulation, etc. The electrical and electronic draftsman also needs a knowledge of other aspects of drafting — isometric and orthagonal projection, screw threads and fasteners, welding representation, etc. These subjects, and more, are covered in the text.

The text of the book is written in clear, easily read language and printed in a clean typeface. To match the text, the numerous illustrations are of a high standard and well reproduced.

In short, this book should be of great value not only to electrical and electronic course students, but also anyone in other drafting fields who may need to learn about electrical and electronic drawing.

The review copy came from the publisher, but copies should be available from the larger book stores. (R.F.)

Steam-age RADAR

RADAR ELECTRONIC FUNDAMENTALS, by the US Department of the Navy and Army. Previously published as Radar Electronics — Fundamentals. Published by Coles Publishing Co, Toronto, Canada. Stiff paper covers, 474 pages, 215 x 135mm, many illustrations and diagrams. Recommended retail price $8.75.

No date is given for the original publication of this book. Judging by the contents, however, it would appear to be just after the Second World War. The first four pages give a brief resume of the principles of RADAR, with the rest of the book occupied with fairly detailed explanations of electrical fundamentals.

There are sections concerned with vacuum tubes, power supply circuits, amplifiers and oscillators, cathode-ray tubes, transmission lines, waveguides, cavity resonators and ultra-high frequency generators (including klystrons and magnetrons), and finally antennas. The book concludes with a glossary of terms and an index.

No mention is made of any of the modern electronic advances, such as semiconductors, integrated circuits and computers. It would appear that this volume would be of most interest to the historian rather than the keen student of electronics. The sole section of the book concerned with RADAR is very limited. (D.W.E.)

Television DX

LONG DISTANCE TELEVISION RECEPTION (TV-DX) FOR THE ENTHUSIAST, by Roger W. Bunney. Bernard Babani (Publishing) Ltd, London, 1978. Soft covers, 111 x 181mm, many illustrations. Price in UK £1.45.

The author of this new book on TV-DX is a regular columnist on the subject, writing in the British magazine "Television". His book is basically an updated and expanded version of an earlier booklet published by that magazine, which ran to three editions.

Intended as an introduction to the subject, the book begins with details of world TV systems and standards, including channel frequencies. Then it discusses relevant aspects of propagation, followed by sections on the requirements of TV-DX in terms of the receiver and the antenna system. The approach taken is very practical, with details given for a variety of receiver "add-ons" and modifications such as IF preamps, masthead amplifiers and adjacent channel traps.

Although written primarily for the British reader, much of the material should be of interest and value to local enthusiasts.

The review copy came direct from the publisher, but copies should arrive here soon. (J.R.)

Notes & Errata

NEW GAME PROGRAMS FOR YOUR 2650 (December 1978, File No. 8/M/32): The hexadecimal listings of the programs given in this article did not reproduce with full clarity. To assist readers who found difficulty in feeding the programs into their system, we reproduce a new and (hopefully) clearer set of listings below.

LIFE: HEX LISTING

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ØCØØ 76 4Ø 75 FF Ø4 F9 C8 27 12 1A 7D 3B 25 12 1A 78
ØC1Ø 3B 1E 3B 1C 12 9A Ø4 Ø5 59 1B Ø7 3B 13 12 1A Ø4
ØC2Ø Ø5 F9 C9 Ø5 1B 32 Ø4 ØD 3B ØF Ø4 ØA 3B ØB 17 59
ØC3Ø 3B ØØ ØB 7B 14 14 FB 7D 17 77 1Ø Ø5 Ø8 3B 71 3B
ØC4Ø 6F 74 4Ø 3B 6B 5Ø 1A Ø4 74 4Ø 1B Ø3 76 4Ø 14 F9
ØC5Ø 72 76 4Ø 3B 5B 75 1Ø 17 1B 1C 77 18 Ø5 ØØ Ø6 Ø8
ØC6Ø 12 1A 7D 14 3B 4C 3B 48 12 14 DØ 51 FA 78 3B 4Ø
ØC7Ø 45 7F Ø1 75 18 17 Ø5 Ø1 3F ØE B6 Ø4 3A 3F ØC 39
ØC8Ø 3F ØC 5A E4 5Ø 1C ØC E8 E4 47 1C ØD 8A E4 4E 98
ØC9Ø 6F 3F ØC 39 Ø5 46 2Ø CD 4E EE 59 7B Ø5 FF 3F ØC
ØCAØ 26 Ø6 Ø8 Ø7 ØØ D3 3F ØC 5A E4 2Ø 13 22 E4 4F 18
ØCBØ 22 E4 ØA 18 1Ø E4 ØD 98 6D 3F ØC 39 85 Ø1 45 FC
ØCCØ A5 Ø1 1B 5D D3 FA 7D Ø3 CD 2E F4 65 Ø3 1B ØF Ø4
ØCDØ 2E 1B Ø2 67 Ø1 3F ØC 39 FA 4B Ø3 CD 2E F4 F5 Ø3
ØCEØ BC ØC A1 E5 3F BC ØC 9E Ø5 FF 3F ØC 26 Ø6 ØØ CA
ØCFØ 15 Ø7 Ø8 ØD 2E F4 DA ØØ 9A Ø2 CA ØA DØ FB 77 F5
ØDØØ Ø3 98 6E A5 Ø4 Ø6 1C 98 Ø6 85 Ø4 1B 1D FB Ø9 Ø7
ØD1Ø Ø8 ØD 2E F4 77 1Ø C2 52 77 1Ø D2 1A Ø4 Ø4 2Ø 1B
ØD2Ø Ø2 Ø4 4F 3F ØC 39 FA 65 65 Ø3 E5 3F 9C ØC EA Ø4
ØD3Ø ØD 3B F1 ØD ØE EF E5 Ø9 99 Ø4 A5 ØA 1B 78 Ø1 24
ØD4Ø 3Ø 3F ØC 39 ØD ØE EE Ø6 ØØ E5 Ø9 99 ØE 86 Ø1 E6
ØD5Ø Ø9 99 Ø2 Ø6 ØØ A5 ØA E5 Ø9 19 72 Ø2 24 3Ø 3F ØC
ØD6Ø 39 Ø1 24 3Ø 3F ØC 39 1F ØC 7B 3B ØB Ø7 Ø9 C2 82
ØD7Ø FB 7D C2 3B Ø2 82 17 3F ØC 5A E4 3Ø 1A 79 E4 39
ØD8Ø 19 75 C3 3F ØC 39 Ø3 44 ØF 17 3F ØC 39 3B 5B CC
ØD9Ø ØE ED Ø5 ØC E4 ØØ 1C ØE BØ Ø5 15 E4 ØF 1A F8 Ø5
ØDAØ 1B E4 37 1A F2 Ø5 21 E4 4C 1A EC Ø5 27 1B E8 Ø5
ØDBØ Ø4 Ø6 Ø4 ØD 4E F4 CE 4F 34 ØE 6F 3Ø CD 6E FØ 5A
ØDCØ Ø2 Ø6 Ø4 59 6E Ø5 FF Ø7 Ø3 85 Ø3 3B 33 Ø8 2F 5Ø
ØDDØ 5Ø C8 2A 3B 14 A5 Ø3 3B 27 Ø8 22 C8 22 3B ØA ØD
ØDEØ 2E F4 77 1Ø C1 Ø7 Ø8 1B 3B ØA 13 Ø8 1Ø CA ØE DØ
ØDFØ DØ C8 ØB 44 Ø3 CF 6E 2Ø FB Ø2 Ø7 Ø3 17 81 21 48
ØE0Ø 2Ø C8 7A C8 79 Ø6 Ø3 ØD 2E FØ 44 55 88 7Ø C8 6E
ØE1Ø ØD 6E FØ 5Ø 44 55 88 65 C8 63 85 Ø3 FA 69 A5 ØC
ØE2Ø 17 Ø1 ØØ Ø1 FB ØE 75 1Ø F5 Ø3 18 Ø4 3B 52 1B Ø4
ØE3Ø Ø8 4D C8 49 75 1Ø 3F ØD E9 77 1Ø Ø8 64 88 63 88
ØE4Ø 62 E4 Ø4 18 1Ø E4 Ø3 18 Ø5 Ø1 1A Ø5 1B Ø7 Ø1 1A
ØE5Ø Ø4 66 Ø1 25 8Ø D1 5B 4C 75 1Ø Ø1 44 Ø3 C2 ØE 6E
ØE6Ø FØ CD 6E FØ 77 1Ø Ø1 75 1Ø CE 6E FØ F5 Ø3 9C ØD
ØE7Ø DF E5 3F 9C ØD C9 Ø5 Ø4 ØD 4E FØ CD 6F 3Ø 59 78
ØE8Ø 77 1Ø Ø2 1C ØE A8 Ø6 ØØ 75 1Ø Ø5 Ø1 8D ØE EE E5
ØE9Ø 64 98 ØA Ø5 Ø1 8D ØE EF CD ØE EF Ø5 ØØ CD ØE EE
ØEAØ ØC ØE ED A4 Ø1 CC ØE ED E4 ØØ 1C ØC E8 1F ØD AF
ØEBØ 3F ØE B6 1F ØD AF ØD 2E BF E4 ØØ 14 3F ØC 39 1B
ØECØ 75 ØD ØA 22 4C 49 46 45 22 ØD ØA ØØ 2Ø 3D 2Ø 32
ØEDØ 35 36 47 2E ØØ 2Ø 3C 3Ø 35 53 ØØ 2Ø 3C 31 35 53
ØEEØ ØØ 2Ø 3C 32 3Ø 53 ØØ 2Ø 3C 32 35 53 ØØ
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ROTATE: HEX LISTING

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Ø44Ø Ø6 FF 3F Ø5 64 Ø5 Ø8 Ø7 F5 1B ØØ 12 9A Ø6 D9 79
Ø45Ø DB 79 1B 71 Ø6 31 66 8Ø F6 Ø3 18 ØA 26 FF F6 Ø3
Ø46Ø 18 Ø2 66 8Ø 26 FF 52 CA 6C 46 ØF 3F Ø4 C4 18 64
Ø47Ø D9 62 DB 6Ø Ø7 ØF 1F Ø4 B5 3F Ø5 44 Ø6 ØF 3F Ø5
Ø48Ø 64 3F Ø2 86 E4 58 1C Ø5 Ø3 E4 ØD 18 ØD 3F Ø4 E7
Ø49Ø 58 6F 3B 3Ø 98 1A Ø6 19 1B 64 Ø3 C2 3B 26 18 76
Ø4AØ 3B 22 3B 2Ø Ø7 ØF Ø6 21 3F Ø5 64 A5 Ø1 95 1B 49
Ø4BØ Ø2 C3 85 67 95 Ø6 4Ø ØE 25 76 E2 18 7A 6Ø 1C Ø5
Ø4CØ 56 1F Ø4 79 F6 Ø3 14 F6 ØC 14 ØE 65 BB C8 13 ØE
Ø4DØ 65 BC CE 65 BB ØE 65 B8 CE 65 BC ØE 65 B7 CE 65
Ø4EØ B8 Ø4 4E CE 65 B7 17 E4 5A 1C Ø5 58 E4 41 1A 12
Ø4FØ E4 5Ø 19 ØE Ø6 1Ø EE 45 B7 18 Ø4 5A 79 9B 22 3F
Ø5ØØ Ø2 B4 17 Ø6 28 3F Ø5 64 3F Ø2 86 3B 5A 58 79 Ø2
Ø51Ø C3 Ø4 2C 3F Ø2 B4 3F Ø2 86 3B 4C 58 79 Ø2 A3 9A
Ø52Ø Ø2 Ø3 A2 E4 Ø1 18 Ø8 E4 Ø4 18 Ø4 Ø6 19 1B 56 ØE
Ø53Ø 65 B7 C8 Ø7 ØF 65 B7 CE 65 B7 Ø4 44 CF 65 B7 Ø7
Ø54Ø ØF 1F Ø4 B2 Ø6 Ø1 ØE 25 B3 14 3F Ø2 B4 F6 Ø3 98
Ø55Ø 75 3F ØØ 8A 1B 7Ø 3B 6C Ø6 34 3B Ø8 3F Ø2 69 3B
Ø56Ø Ø3 1F Ø4 4Ø ØE 25 6D 14 3F Ø2 B4 1B 77 ØA 5Ø 52
Ø57Ø 45 53 53 2Ø 41 4E 59 2Ø 4B 45 59 ØØ ØØ ØA 52 4F
Ø58Ø 54 41 54 45 3A 2Ø ØØ ØA 57 48 41 54 3F 2Ø ØØ 43
Ø59Ø 41 4E 43 45 4C ØØ ØA 45 58 43 48 41 4E 47 45 3A
Ø5AØ 2Ø ØØ ØA 59 4F 55 2Ø 54 4F 4F 4B 2Ø ØØ 2Ø 4D 4F
Ø5BØ 56 45 53 ØA ØØ ØD ØA 4D 4E 48 41 4B 5Ø 49 44 43
Ø5CØ 45 4A 4F 46 4C 42 47 ØØ
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MUSIC: HEX LISTING

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Ø4AØ Ø4 ØØ ØC A5 56 1E Ø5 58 C2 44 7Ø 24 7Ø C1 51 51
Ø4BØ 51 81 51 77 1Ø 83 C3 86 ØØ 75 11 46 ØF D2 ØE 65
Ø4CØ BC C3 ØE 25 BC Ø6 FF E5 ØØ 18 Ø5 DØ D3 D2 F9 7B
Ø4DØ 75 Ø1 84 8Ø 87 ØØ 86 ØØ CB 22 CA 1F 77 1Ø 87 44
Ø4EØ 86 Ø1 9A Ø6 87 ØE 86 ØØ 1A 7A ØD 85 56 77 Ø1 AB
Ø4FØ Ø9 AA Ø6 76 4Ø Ø4 Ø8 1B 31 28 ØØ F9 5A AB 7B AA
Ø5ØØ 78 93 Ø7 8C 8B 76 8A 73 9A Ø6 87 ØE 86 ØØ 1A 7A
Ø51Ø 53 13 53 B5 Ø1 98 Ø3 1B Ø1 CØ 47 Ø3 9F Ø5 1F CØ
Ø52Ø CØ CØ 93 12 24 4Ø 92 13 77 11 AB 5Ø AA 4D 9A Ø5
Ø53Ø 93 Ø7 8Ø 1B 4F F9 46 44 Ø1 4C Ø4 FC 64 18 93 8F
Ø54Ø Ø4 FC 8E Ø4 FB 75 11 ØB ØE ØA ØB 87 Ø2 86 ØØ CB
Ø55Ø Ø6 CA Ø3 1F Ø4 AØ Ø6 B6 77 1Ø E4 FF 1C ØØ 22 Ø9
Ø56Ø F5 87 8A 86 ØØ 9A Ø6 87 ØE 86 ØØ 1A 7A 74 4Ø 75
Ø57Ø Ø1 86 Ø2 77 Ø1 AF Ø4 FA AE Ø4 F9 87 1E 86 ØØ 87
Ø58Ø ØE 86 ØØ 1A 7A F9 6E A6 Ø2 1F Ø5 45 75 FF 3F Ø2
Ø59Ø DB ØC Ø4 2A 98 Ø6 ØA 23 Ø9 2Ø 1B Ø4 CA 1D C9 1A
Ø5AØ CE Ø5 57 CD Ø5 56 3F Ø2 DB 77 Ø8 ØC Ø4 2A 1C Ø4
Ø5BØ AØ CE Ø4 FA CD Ø4 F9 1F Ø4 AØ Ø5 D4 Ø2 FC 11 2F
Ø5CØ 1E 97 2B 3E 37 2F 42 74 4D 17 57 22 6Ø 9C 69 8E
Ø5DØ 72 ØØ 79 F8
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YANKEE DOODLE: HEX LISTING

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Ø5D4 8Ø 8Ø Ø8 43 Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 45
Ø5EØ Ø8 8Ø Ø8 47 Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 47 Ø8 8Ø Ø8 45
Ø5FØ Ø8 8Ø Ø8 3A Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 45
Ø6ØØ Ø8 8Ø Ø8 47 Ø8 8Ø 14 43 Ø8 8Ø Ø8 42 Ø8 8Ø Ø8 3A
Ø61Ø Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 45 Ø8 8Ø Ø8 47
Ø62Ø Ø8 8Ø Ø8 48 Ø8 8Ø Ø8 47 Ø8 8Ø Ø8 45 Ø8 8Ø Ø8 43
Ø63Ø Ø8 8Ø Ø8 42 Ø8 8Ø Ø8 3A Ø8 8Ø Ø8 4Ø Ø8 8Ø Ø8 42
Ø64Ø Ø8 8Ø 1Ø 43 ØC 8Ø 1Ø 43 1Ø 8Ø Ø8 4Ø 1Ø 8Ø Ø8 42
Ø65Ø Ø2 8Ø Ø8 4Ø Ø8 8Ø Ø8 3A Ø8 8Ø Ø8 4Ø Ø8 8Ø Ø8 42
Ø66Ø Ø8 8Ø 1Ø 43 1Ø 8Ø Ø8 3A 1Ø 8Ø Ø8 4Ø Ø2 8Ø Ø8 3A
Ø67Ø Ø8 8Ø Ø8 38 Ø8 8Ø 1Ø 37 1Ø 8Ø 1Ø 3A 1Ø 8Ø Ø8 4Ø
Ø68Ø 1Ø 8Ø Ø8 42 Ø2 8Ø Ø8 4Ø Ø8 8Ø Ø8 3A Ø8 8Ø Ø8 4Ø
Ø69Ø Ø8 8Ø Ø8 42 Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 4Ø Ø8 8Ø Ø8 3A
Ø6AØ Ø8 8Ø Ø8 43 Ø8 8Ø Ø8 42 Ø8 8Ø Ø8 45 Ø8 8Ø 1Ø 43
Ø6BØ ØC 8Ø 1Ø 43 8Ø 8Ø Ø2 FF
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BACH: HEX LISTING

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Ø6B8 8Ø 8Ø Ø6 43 Ø6 45 Ø4 47
Ø6CØ Ø4 4A Ø4 48 Ø4 48 Ø4 5Ø Ø4 4A Ø4 4A Ø4 53 Ø4 52
Ø6DØ Ø4 53 Ø4 4A Ø4 47 Ø4 43 Ø4 45 Ø4 47 Ø4 4Ø Ø4 4A
Ø6EØ Ø4 48 Ø4 47 Ø4 45 Ø4 43 Ø4 3A Ø4 43 Ø4 42 18 43
Ø6FØ ØC 8Ø 18 47 ØC 43 18 4A ØC 4A 18 48 ØC 47 18 45
Ø7ØØ Ø6 8Ø Ø6 8Ø 18 47 ØC 48 18 4A ØC 47 Ø6 45 Ø3 47
Ø71Ø Ø3 48 ØC 47 ØC 45 18 43 ØC 8Ø Ø2 8Ø Ø6 43 Ø6 45
Ø72Ø Ø4 47 Ø4 4A Ø4 48 Ø4 48 Ø4 5Ø Ø4 4A Ø4 4A Ø4 53
Ø73Ø Ø4 52 Ø4 53 Ø4 4A Ø4 47 Ø4 43 Ø4 45 Ø4 47 Ø4 4Ø
Ø74Ø Ø4 4A Ø4 48 Ø4 47 Ø4 45 Ø4 43 Ø4 3A Ø4 43 Ø4 42
Ø75Ø Ø4 43 Ø4 47 Ø4 4A Ø4 53 Ø4 4A Ø4 47 Ø4 43 Ø4 47
Ø76Ø Ø4 49 18 4A Ø6 8Ø Ø2 3Ø Ø3 8Ø Ø6 43 Ø6 45 Ø4 47
Ø77Ø Ø4 4A Ø4 48 Ø4 48 Ø4 5Ø Ø4 4A Ø4 4A Ø4 53 Ø4 52
Ø78Ø Ø4 53 Ø4 4A Ø4 47 Ø4 43 Ø4 45 Ø4 47 Ø4 4Ø Ø4 4A
Ø79Ø Ø4 48 Ø4 47 Ø4 45 Ø4 43 Ø4 3A Ø4 43 Ø4 42 18 43
Ø7AØ 8Ø 8Ø Ø2 FF
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TRS-80 BIORHYTHMS (November 1978, File No. 8/M/31): A number of errors have been found in the program listing, caused by faulty printing of the original listing from which it was prepared. The corrections are:

1. Line 400 should begin with V=0, not Y=0.
2. Line 499 should begin: P.T. (10), "HERE COME . . .
3. Line 520 should begin: F.X=325 TO 327 S.2:
4. Line 545 should read P.A.709, B: P.A.739, "BIRTHDATE ="; G; H; J: GOS.800
5. Line 600 should begin O=14:
6. Line 475: note that the third section reads Q=I + (7-Q):

CAR BURGLAR ALARM (November 1976. File No. 3/AU/16): Some readers have reported a problem involving spontaneous arming of the circuit when other electrical devices, such as the starter, are operated. Others have reported a tendency for the alarm circuit to re-trigger after automatic horn shutdown.

Both are due to spikes or noise on the battery line being fed into the appropriate sections of the circuit. Two modifications are suggested. For the first problem the 100k resistor between pins 2 and 4 of A1 is changed to two 47k resistors and the junction connected to a tantalum capacitor, which connects to chassis. The same junction connects to a diode, the cathode end of which connects to pin 4.

For the second problem the line between pin 3 of B1

(Continued opposite)

INFORMATION CENTRE

MORSE CODE DECODER: I have recently read in a U.S. magazine an article on the construction of a decoder that automatically decodes Morse code signals and displays them alpha-numerically. I would like to know whether your magazine would be interested in this idea as a project. I would also like to know whether you have published articles on radio control of models.

● The possibility of a Morse code decoder has occurred to us and one staff member has gone so far as to work out a likely way to approach the problem, both technically and in terms of available components. However, the design would involve a fair amount of work and, at present, pressure of more popular projects prevents the necessary time being available. As the staff member put it, "Keep your fingers crossed — but don't hold your breath!"

We have described a few model control circuits in the past, but these are now quite dated. A problem here is that the subject is as much, or more, one of mechanical hardware as it is of electronic circuitry.

DIP OSCILLATOR: I would like to request that you run a project for a dip oscillator. While many circuits of dip oscillators have been published in the past I have yet to see a project which included high level calibration, FET oscillator and a very precise dip at a very precise frequency.

Accessories would also be needed to use with the dipper. This would include use as resonating antennas, as an RF oscillator for the alignment of tuned circuits and other varied uses.

You may ask why I require a project such as this. The simple explanation is "calibration". The dial must be calibrated to within 0.1% as a maximum, any less degree of accuracy the instrument would be useless. I place this thought in your capable hands, with the suggestion that a range of 0.5 to 30MHz would be desirable. (L.T., Duffy, ACT).

● A tall order indeed! To obtain the order of accuracy laid down would require very precise hand-spread ranges, calling for a large number of coils to cover from say 0.5 to 30MHz. Having done this, in the case of a home made dipper, the problem of providing an accurately calibrated scale is a difficult one to solve. If a builder has all the facilities to accurately calibrate a scale then well and good. However, in most cases, readers would want a ready made scale so that they could just drop it into position. Unfortunately, such a scale would not give the required accuracy because of spreads in tolerances of components, leading to variations in calibration points.

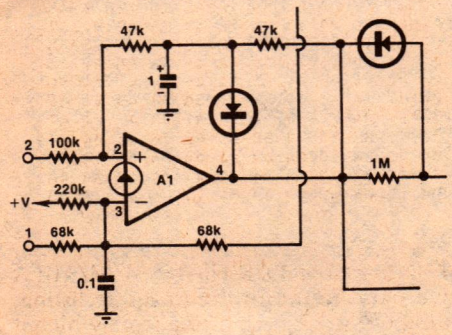
As if that is not enough! Basically, and by its very nature, a dip oscillator is not a very precise instrument. Where circuits have to be coupled for dipping, a certain amount of error is introduced by the amount of coupling, the accuracy of setting and reading of the dial scale. The popular dipper is normally used to give an approximate measurement,which may be followed up later by more accurate methods. However, we agree that it may be worth while taking a look at the possibility of describing a new dipper.

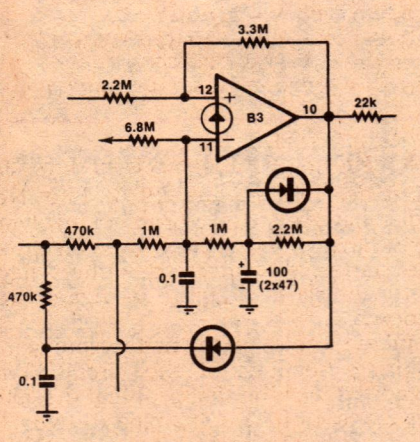
PERSONAL COMPUTER: I am very interested in buying a minicomputer for personal use. Do you know of any minicomputers on the market, either in kit form or built up, that do not operate in hexadecimal but in BASIC? I am interested in one like your Mini Scamp, which does not need an expensive terminal to go with it. But I also want one which can be expanded. (D.S.L., Beaumaris, Vic.)

To a certain extent you are asking for the impossible. By their very nature, high level languages like BASIC require the flexibility of interaction which can only be provided by a full-keyboard type terminal; it is not really feasible to program a system running BASIC using only a set of front-panel switches.

The cheapest way of getting a personal computer which is programmed in BASIC is probably to buy one of the low cost integrated systems like the Tandy TRS-80 (Tandy Electronics) or the Apple (Computerland), which have a video terminal built into the computer. At present this type of system will cost you around $800-$1000, but lower cost systems will be available before long.

NOTES & ERRATA contd.





and pin 10 of B3 is modified. A diode is connected between the (lower) 470k resistor and pin 10, with the cathode towards the resistor. From the junction a 0.1uF capacitor connects to chassis.

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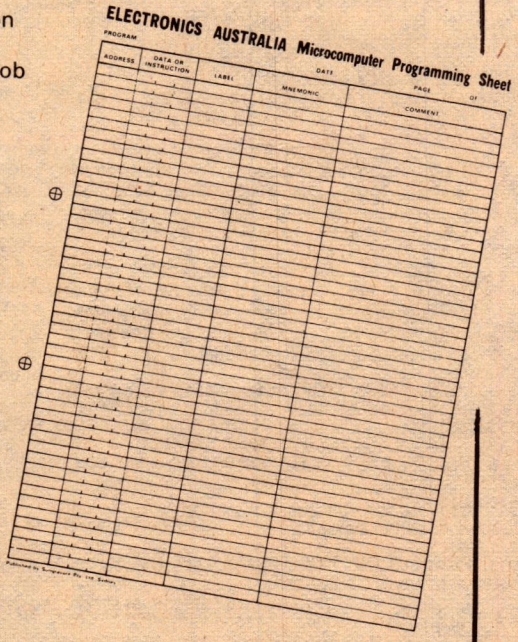

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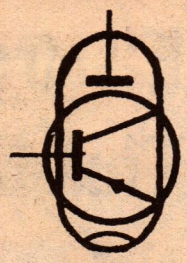

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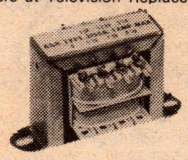

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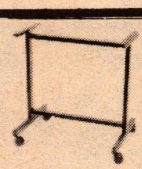

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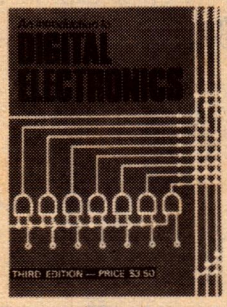

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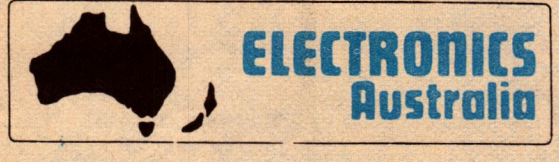

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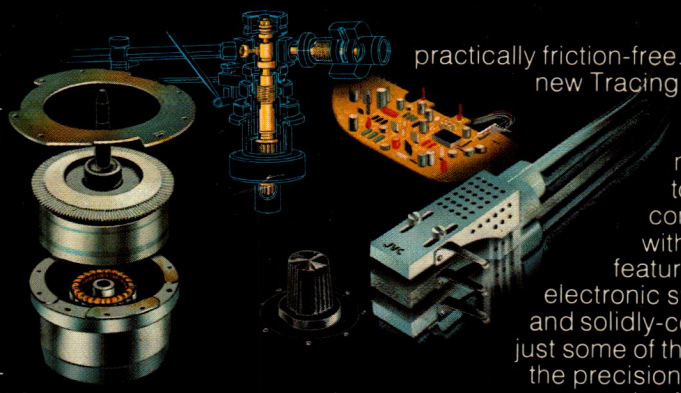

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